

Historic, Archive Document

Do not assume content reflects current
scientific knowledge, policies, or practices.

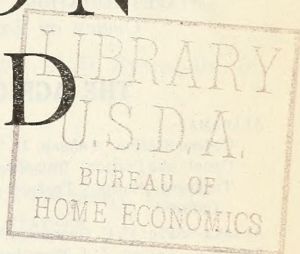






38 44477
U. S. DEPARTMENT OF AGRICULTURE
STATES RELATIONS SERVICE

EXPERIMENT STATION RECORD



VOLUME XLVI

JANUARY-JUNE, 1922

SEP 27 1926

246R

v. 46

LIBRARY,

BUREAU OF HOME ECONOMICS.



WASHINGTON
GOVERNMENT PRINTING OFFICE
1923

U. S. DEPARTMENT OF AGRICULTURE.

Scientific Bureaus.

WEATHER BUREAU—C. F. Marvin, *Chief*.
BUREAU OF ANIMAL INDUSTRY—J. R. Mohler, *Chief*.
BUREAU OF PLANT INDUSTRY—W. A. Taylor, *Chief*.
FOREST SERVICE—W. B. Greeley, *Forester*.
BUREAU OF CHEMISTRY—W. G. Campbell, *Acting Chief*.
BUREAU OF SOILS—Milton Whitney, *Chief*.
BUREAU OF ENTOMOLOGY—L. O. Howard, *Entomologist*.
BUREAU OF BIOLOGICAL SURVEY—E. W. Nelson, *Chief*.
BUREAU OF PUBLIC ROADS—T. H. MacDonald, *Chief*.
BUREAU OF AGRICULTURAL ECONOMICS—H. C. Taylor, *Chief*.
FIXED NITROGEN RESEARCH LABORATORY—F. G. Cottrell, *Director*.

STATES RELATIONS SERVICE—A. C. True, *Director*.

OFFICE OF EXPERIMENT STATIONS—E. W. Allen *Chief*.

THE AGRICULTURAL EXPERIMENT STATIONS.

ALABAMA—

College Station: *Auburn*; D. T. Gray.¹
Canebrake Station: *Uniontown*; ———.
Tuskegee Station: *Tuskegee Institute*; G. W. Carver.¹

ALASKA—*Sitka*: C. C. Georgeson.²

ARIZONA—*Tucson*: J. J. Thornber.¹

ARKANSAS—*Fayetteville*: Bradford Knapp.¹

CALIFORNIA—*Berkeley*: C. M. Haring.¹

COLORADO—*Fort Collins*: C. P. Gillette.¹

CONNECTICUT—

State Station: *New Haven*; } E. H. Jenkins.¹
Storrs Station: *Storrs*; }

DELAWARE—*Newark*: C. A. McCue.¹

FLORIDA—*Gainesville*: W. Newell.¹

GEORGIA—

Experiment: H. P. Stuckey.¹
Tifton: Coastal Plains Station; S. H. Starr.¹

GUAM—*Island of Guam*: C. W. Edwards.³

HAWAII—

Federal Station: *Honolulu*; J. M. Westgate.²
Sugar Planters Station: *Honolulu*; H. P. Agee.¹

IDAHO—*Moscow*: E. J. Iddings.¹

ILLINOIS—*Urbana*: H. W. Mumford.¹

INDIANA—*La Fayette*: G. I. Christie.¹

IOWA—*Ames*: C. F. Curtiss.¹

KANSAS—*Manhattan*: F. D. Farrell.¹

KENTUCKY—*Lexington*: T. P. Cooper.¹

LOUISIANA—

State Station: *Baton Rouge*; }
Sugar Station: *Audubon Park*, } W. R. Dodson.¹
New Orleans; }
North La. Station: *Calhoun*; }
Rice Station: *Crowley*; }

MAINE—*Orono*: W. J. Morse.¹

MARYLAND—*College Park*: H. J. Patterson.¹

MASSACHUSETTS—*Amherst*: S. B. Haskell.¹

MICHIGAN—*East Lansing*: R. S. Shaw.¹

MINNESOTA—*University Farm, St. Paul*: W. C. Coffey.¹

MISSISSIPPI—*Agricultural College*: J. R. Ricks.¹

¹ Director.

² Agronomist in charge.

³ Animal husbandman in charge.

MISSOURI—

College Station: *Columbia*; F. B. Mumford.¹
Fruit Station: *Mountain Grove*; F. W. Faurot.¹
Poultry Station: *Mountain Grove*; T. W. Noland.¹

MONTANA—*Bozeman*: F. B. Linfield.¹

NEBRASKA—*Lincoln*: E. A. Burnett.¹

NEVADA—*Reno*: S. B. Doten.¹

NEW HAMPSHIRE—*Durham*: J. C. Kendall.¹

NEW JERSEY—*New Brunswick*: J. G. Lipman.¹

NEW MEXICO—*State College*: Fabian Garcia.¹

NEW YORK—

State Station: *Geneva*; R. W. Thatcher.¹
Cornell Station: *Ithaca*; A. R. Mann.¹

NORTH CAROLINA—*Raleigh*: B. W. Kilgore.¹

NORTH DAKOTA—*Agricultural College*: P. F. Trowbridge.¹

OHIO—*Wooster*: C. G. Williams.¹

OKLAHOMA—*Stillwater*: C. T. Dowell.¹

OREGON—*Corvallis*: J. T. Jardine.¹

PENNSYLVANIA—

State College: *R. L. Watts*.¹
State College: Institute of Animal Nutrition;
E. B. Forbes.¹

PORTO RICO—

Federal Station: *Mayaguez*; R. M. Ramos.¹
Insular Station: *Rio Piedras*; J. Mantz.¹

RHODE ISLAND—*Kingston*: B. L. Hartwell.¹

SOUTH CAROLINA—*Clemson College*: H. W. Barre.¹

SOUTH DAKOTA—*Brookings*: J. W. Wilson.¹

TENNESSEE—*Knoxville*: H. A. Morgan.¹

TEXAS—*College Station*: B. Youngblood.¹

UTAH—*Logan*: William Peterson.¹

VERMONT—*Burlington*: J. L. Hills.¹

VIRGINIA—

Blacksburg: A. W. Drinkard, jr.¹
Norfolk: Truck Station; T. C. Johnson.¹

VIRGIN ISLANDS—*St. Croix*: J. B. Thompson.¹

WASHINGTON—

College Station: *Pullman*; E. C. Johnson.¹
Western Station: *Puyallup*; W. A. Linklater.⁴

WEST VIRGINIA—*Morgantown*: H. G. Knight.¹

WISCONSIN—*Madison*: H. L. Russell.¹

WYOMING—*Laramie*: J. A. Hill.]

⁴ Superintendent.

⁵ Acting director.

- 1280092 -

EXPERIMENT STATION RECORD.

Editor: E. W. ALLEN, PH. D., *Chief, Office of Experiment Stations.*

Associate Editor: H. L. KNIGHT.

EDITORIAL DEPARTMENTS.

Agricultural Chemistry and Agrotechny—SYBIL L. SMITH.

Meteorology—W. H. BEAL.

Soils and Fertilizers—R. W. TRULLINGER.

Agricultural Botany, Bacteriology, and Plant Pathology—W. H. EVANS, Ph. D.,
W. E. BOYD.

Field Crops—H. M. STEECE.

Horticulture and Forestry—J. W. WELLINGTON.

Economic Zoology and Entomology—W. A. HOOKER, D. V. M.

Foods and Human Nutrition—SYBIL L. SMITH, C. F. LANGWORTHY, Ph. D.

Animal Husbandry, Dairying, and Dairy Farming, G. HAINES.

Veterinary Medicine—W. A. HOOKER, SYBIL L. SMITH.

Rural Engineering—R. W. TRULLINGER.

Rural Economics and Sociology and Agricultural Education—LOUISE MARBUT.

Indexes—MARTHA C. GUNDLACH.

With the cooperation of W. H. Beal in Soils and Fertilizers, E. Merritt in
Rural Economics and Sociology, and E. H. Shinn in Agricultural Education.

CONTENTS OF VOLUME XLVI.

EDITORIAL NOTES.

Page.

Agriculture at the Toronto meeting of the American Association.....	1
Research from the standpoint of the problem and the locality.....	101
Common interest in the progress of specialized inquiry.....	105
Agricultural research at the National Agricultural Conference.....	301
The claim of duplication.....	401
The evidence of projects and publications.....	404
Duplication v. conventionalism.....	406
Home economics at the experiment stations.....	601
An agricultural conference at the University of Illinois.....	701

STATION PUBLICATIONS ABSTRACTED.

ALABAMA TUSKEGEE STATION:

Bulletin 38, February 2, 1922.....	730
------------------------------------	-----

ARKANSAS STATION:

Bulletin 176, November, 1921.....	667
Bulletin 177, November, 1921.....	658

CALIFORNIA STATION:

	Page.
Bulletin 331, October, 1921	540
Bulletin 332, June, 1921	235
Bulletin 333, October, 1921	163
Bulletin 334, October, 1921	342
Bulletin 335, November, 1921	576
Bulletin 336, November, 1921	350
Bulletin 337, November, 1921	509
Bulletin 338, December, 1921	537
Circular 227, June, 1921	238
Circular 228, June, 1921	40
Circular 229, November, 1921	540
Circular 230 [1921]	578
Circular 231, December, 1921	540

COLORADO STATION:

Bulletin 267, July, 1921	28
Bulletin 268, July, 1921	55

CONNECTICUT STATE STATION:

Bulletin 230, June, 1921	154
Bulletin 231, September, 1921	312, 318, 322, 332; 340, 394
Bulletin 232 (Report, 1921), October, 1921	598
Bulletin 233, November, 1921	522
Forty-fourth Annual Report, 1920	697

CONNECTICUT STORRS STATION:

Bulletin 107, November, 1921	835
------------------------------	-----

DELAWARE STATION:

Bulletin 128, June 20, 1921	239
Bulletin 129 (Annual Report, 1921), November, 1921	624,
	627, 639, 642, 645, 651, 698

GEORGIA STATION:

Bulletin 139, December, 1921	553
Bulletin 140, December, 1921	538

GUAM STATION:

Bulletin 1, December 2, 1921	440
Report, 1920	711, 715, 725, 733, 748, 763, 793

HAWAII STATION:

Bulletin 46, December 16, 1921	440
Report, 1920	623, 633, 640, 643, 647, 674, 679, 698

HAWAIIAN SUGAR PLANTERS' STATION:

Botanical Series Bulletin, vol. 3, No. 1, August, 1921	344, 34, 347
--	--------------

IDAHO STATION:

Bulletin 125, August, 1921	171
Bulletin 126, November, 1921	686
Circular 20, December, 1921	698
Circular 21, February, 1922	839

ILLINOIS STATION:

Bulletin 234, October, 1921	365
Bulletin 235, November, 1921	369
Bulletin 236, December, 1921	373
Bulletin 237, December, 1921	578
Bulletin 238, January, 1922	677
Circular 248, December, 1921	597

ILLINOIS STATION—Continued.

Page.

Circular 249, December, 1921.....	578
Circular 250, December, 1921.....	577
Circular 251, January, 1922.....	697
Circular 252, March, 1922.....	855
Soil Report 19, October, 1921.....	315
Soil Report 20, December, 1921.....	712

INDIANA STATION:

Bulletin 254, July, 1921.....	205
Bulletin 255, 1921.....	476
Bulletin 256, September, 1921.....	477
Bulletin 257, October, 1921.....	582
Bulletin 258, November, 1921.....	574
Circular 104, December, 1921.....	768

IOWA STATION:

Bulletin 199, July, 1921.....	736
Bulletin 200, July, 1921.....	90
Research Bulletin 62, October, 1920.....	144
Research Bulletin 63, October, 1920.....	76
Research Bulletin 64, November, 1920.....	76
Research Bulletin 65, November, 1920.....	77
Circular 69, July, 1921.....	386
Circular 70, July, 1921.....	73
Circular 71, September, 1921.....	477
Circular 72, September, 1921.....	477
Annual Report, 1920.....	317,
321, 326, 334, 341, 342, 344, 345, 349, 362, 366, 370, 383, 385, 394	

KANSAS STATION:

Bulletin 226, September, 1921.....	30
Circular 92, November, 1921.....	366
Report, 1920.....	434, 444, 448, 467, 475, 476, 478, 485, 498

KENTUCKY STATION:

Bulletin 230, December 31, 1920.....	322
Bulletin 231, March, 1921.....	57
Bulletin 232, May, 1921.....	33
Bulletin 233, July, 1921.....	71
Bulletin 234, July, 1921.....	372
Bulletin 235, September, 1921.....	572
Circular 25, June, 1921.....	157
Circular 26, October, 1921.....	367
Circular 27, October, 1921.....	462
Thirty-second Annual Report, 1919, pt. 2.....	297
Thirty-third Annual Report, 1920, pt. 1.....	809,
816, 830, 832, 846, 848, 874, 875, 883, 885, 898	

LOUISIANA STATIONS:

Bulletin 182, September, 1921.....	145
Bulletin 183, October, 1921.....	281
Bulletin 184, November, 1921.....	849

MAINE STATION:

Bulletin 300, July, 1921.....	173
Official Inspection 99, April, 1921.....	60
Official Inspection 100, August, 1921.....	572

MARYLAND STATION :

Page.

Bulletin 242, January, 1921-----	321
Bulletin 243, April, 1921-----	233

MASSACHUSETTS STATION :

Bulletin 200, October, 1920-----	476
Bulletin 201, March, 1921-----	38
Bulletin 202, August, 1921-----	653
Bulletin 203, September, 1921-----	651
Meteorological Bulletins 393-394, September-October, 1921-----	209
Meteorological Bulletins 395-396, November-December, 1921-----	419
Meteorological Bulletins 397-398, January-February, 1922-----	809
Thirty-third Annual Report, 1920, pt. 1-----	19, 21, 30, 43, 50, 52, 81, 96

MICHIGAN STATION :

Bulletin 292, June, 1921-----	163
Technical Bulletin 52, November, 1921-----	479
Special Bulletin 108, March, 1921-----	132
Special Bulletin 109, July, 1921-----	633
Circular 47, May, 1921-----	468
Quarterly Bulletin, vol. 4, No. 2, November, 1921-----	518,
535, 537, 542, 552, 558, 559, 577, 582, 584, 588, 598	
Thirty-third Annual Report, 1920-----	412,
413, 443, 444, 448, 457, 466, 478, 482, 484, 498	

MINNESOTA STATION :

Bulletin 195, September, 1921-----	290
Bulletin 196, August, 1921-----	493
Bulletin 197, September, 1921-----	346
Technical Bulletin 1, June, 1921-----	854
Technical Bulletin 2, June, 1921-----	852
Technical Bulletin 3, September, 1921-----	828

MISSISSIPPI STATION :

Technical Bulletin 9, December, 1920-----	461
Technical Bulletin 10, May, 1921-----	461
Circular 37, March, 1921-----	532
Circular 39, September, 1921-----	590
Circular 40, December, 1921-----	729

MISSOURI STATION :

Bulletin 187, June, 1921-----	378
Bulletin 188, July, 1921-----	34
Bulletin 189 (Annual Report, 1921), October, 1921-----	315,
323, 326, 332, 335, 343, 344, 349, 363, 370, 371, 377, 379, 385, 387, 394	
Research Bulletin 43, July, 1921-----	66
Research Bulletin 44, August, 1921-----	16
Research Bulletin 45, August, 1921-----	362
Research Bulletin 46, August, 1921-----	331
Research Bulletin 47, September, 1921-----	337
Research Bulletin 48, December, 1921-----	827
Circular 105, February, 1922-----	834
Guide 1, March, 1921-----	511
Manual of the Principal Soils of Missouri, M. F. Miller and H. H. Krusekopf-----	511

MISSOURI FRUIT STATION :

Circular 20, February, 1921-----	140
Biennial Report, 1915-16-----	297

MISSOURI FRUIT STATION—Continued.

Biennial Report, 1917-18	297
Biennial Report, 1919-20	297

MONTANA STATION :

Bulletin 142, April, 1921	830
Circular 96, March, 1921	269
Circular 97, July, 1921	273
Circular 98, August, 1921	651
Circular 99, October, 1921	695
Circular 100, August, 1921	693
Twenty-seventh Annual Report, 1920	314, 316, 327, 334, 342, 364, 374, 394

NEBRASKA STATION :

Bulletin 179, February, 1922	837
------------------------------	-----

NEW HAMPSHIRE STATION :

Bulletin 198 (Biennial Report, 1919-20), May, 1921	318, 328, 335, 343, 350, 367, 394
Bulletin 199, June, 1921	394
Bulletin 200, August, 1921	674
Technical Bulletin 18, June, 1921	138

NEW JERSEY STATIONS :

Circular 125, August, 1921	137
Circular 126, August, 1921	156
Circular 127, October, 1921	273
Hints to Poultrymen, vol. 10—	
No. 1, October, 1921	189
No. 2, November, 1921	273
No. 3, December, 1921	369
No. 4, January, 1922	678
No. 5, February, 1922	877
Annual Report, 1920	510, 513, 514, 519, 525, 526, 529, 530, 534, 536, 540, 547, 548, 549, 554, 555, 574, 576, 583, 584, 590, 598

NEW MEXICO STATION :

Bulletin 126, May, 1921	135, 169, 173
Thirty-first Annual Report, 1920	346, 352, 365, 370, 372, 394

NEW YORK CORNELL STATION :

Bulletin 405, July, 1921	287
Bulletin 406, August, 1921	212
Bulletin 407, August, 1921	249
Memoir 38, June, 1920	57
Memoir 40, July, 1921	323
Memoir 41, July, 1921	210
Memoir 42, July, 1921	648
Memoir 43, July, 1921	274
Memoir 44, August, 1921	459
Memoir 45, August, 1921	654
Memoir 46, September, 1921	831
Memoir 47, October, 1921	465
Memoir 48, November, 1921	634
Memoir 49, November, 1921	751
Memoir 50, December, 1921	870
Memoir 51, December, 1921	853
Memoir 52, January, 1922	828
Thirty-fourth Annual Report, 1921	898

NEW YORK STATE STATION :

Page.

Bulletin 485 (popular edition), April, 1921.....	348
Bulletin 487, April, 1921.....	351
Technical Bulletin 81, January, 1921.....	308
Technical Bulletin 83, April, 1921.....	317
Technical Bulletin 84, July, 1921.....	431
Technical Bulletin 85, August, 1921.....	423
Technical Bulletin 87, October, 1921.....	479
Thirty-ninth Annual Report, 1920.....	618, 698

NORTH CAROLINA STATION :

Bulletin 243, October, 1921.....	269
Technical Bulletin 20, December, 1921.....	739
Farmers' Market Bulletin—	
Volume 8—	
No. 46, November 18, 1921.....	390
Volume 9—	
No. 47, January, 1922.....	595
No. 48, February, 1922.....	789

NORTH DAKOTA STATION :

Bulletin 152, September, 1921.....	330
Bulletin 153, November, 1921.....	330
Bulletin 154, November, 1921.....	367

OHIO STATION :

Bulletin 350, June, 1921.....	665
Bulletin 351, June, 1921.....	428
Bulletin 352, June, 1921.....	510
Monthly Bulletin, vol. 6—	
No. 7-8, July-August, 1921.....	334, 350, 368, 394
No. 9-10, September-October, 1921.....	333, 336, 347, 394
No. 11-12, November-December, 1921.....	736, 749, 750, 768, 782, 793

OREGON STATION :

Bulletin 180, August, 1921.....	171
Bulletin 181, September, 1921.....	234
Bulletin 182, September, 1921.....	169
Bulletin 183, September, 1921.....	170
Bulletin 184, September, 1921.....	170
Bulletin 185, November, 1921.....	214
Bulletin 186, November, 1921.....	641
Circular 23, February, 1922.....	838

PORTO RICO STATION :

Bulletin 28, December 14, 1921.....	454
Circular 19 (Spanish edition), October, 1921.....	370
Circular 20, November 2, 1921.....	157

PORTO RICO DEPARTMENT OF AGRICULTURE AND LABOR STATION :

Circular 41 (Spanish edition), April, 1921.....	558
Circular 42 (Spanish edition), January, 1921.....	580
Circular 43 (Spanish edition), May, 1921.....	553
Circular 44 (Spanish edition), August, 1921.....	558
Circular 45 (Spanish edition), August, 1921.....	580
Circular 46 (Spanish edition), August, 1921.....	582

RHODE ISLAND STATION :

Annual Fertilizer Circular, October, 1921.....	221
Thirty-third Annual Report, 1920.....	213, 217, 220, 226, 227, 233, 297

SOUTH CAROLINA STATION :		Page.
Bulletin 208, September, 1921	-----	124
Thirty-fourth Annual Report, 1921	----- 717, 725, 733, 741, 747, 768, 771, 793	
TENNESSEE STATION :		
Bulletin 124, May, 1921	-----	133
Bulletin 125, June, 1921	-----	169
TEXAS STATION :		
Bulletin 280, August, 1921	-----	124
Bulletin 281, October, 1921	-----	675
Thirty-third Annual Report, 1920	----- 328, 335, 343, 365, 394	
VERMONT STATION :		
Bulletin 222, July, 1921	-----	138
Bulletin 223, September, 1921	----- 522, 536, 572	
VIRGIN ISLANDS STATION :		
Bulletin 2, September 12, 1921	-----	33
VIRGINIA STATION :		
Bulletin 226, November, 1921	-----	648
Technical Bulletin 21, March, 1921	-----	659
Technical Bulletin 22, June, 1921	-----	155
VIRGINIA TRUCK STATION :		
Bulletin 33-34, October 1, 1920-January 1, 1921	-----	336
WASHINGTON STATION :		
Bulletin 164, June, 1921	-----	216
Bulletin 165, May, 1921	-----	427
Popular Bulletin 121, September, 1921	-----	817
Western Washington Station Bimonthly Bulletin, vol. 9--		
No. 5, November, 1921	----- 215, 233, 297	
No. 6, January, 1922	----- 437, 449, 478, 498	
WEST VIRGINIA STATION :		
Bulletin 176, June, 1921	-----	191
WISCONSIN STATION :		
Bulletin 335, June, 1921	-----	74
Bulletin 336, October, 1921	-----	288
Bulletin 337, October, 1921	-----	333
Research Bulletin 50, September, 1921	-----	185
Research Bulletin 51, December, 1921	-----	894
WYOMING STATION :		
Bulletin 128, June, 1921	-----	676

UNITED STATES DEPARTMENT OF AGRICULTURE PUBLICATIONS
ABSTRACTED.

Annual Reports, 1920	-----	598
Bulletin 947, Western Sneezeweed (<i>Helenium hoopesii</i>) as a Poisonous Plant, C. D. Marsh et al	-----	82
Bulletin 959, Experiments and Suggestions for the Control of the Codling Moth in the Grand Valley of Colorado, E. H. Siegler and H. K. Plank	-----	54
Bulletin 965, Control of the Argentine Ant in California Citrus Orchards, R. S. Woglum and A. D. Borden	-----	160
Bulletin 967, Results of Work on Blister Beetles in Kansas, F. B. Miliken	-----	158
Bulletin 969, The Mexican Whorled Milkweed (<i>Asclepias mexicana</i>) as a Poisonous Plant, C. D. Marsh and A. B. Clawson	-----	280

Bulletin 971, Inheritance of Ramose Inflorescence in Maize, J. H. Kempton.....	Page. 229
Bulletin 974, Directions for Blueberry Culture, 1921, F. V. Coville.....	140
Bulletin 975, Food Values: How Foods Meet Body Needs, E. A. Winslow.....	465
Bulletin 976, Cultural Experiments with Grain Sorghums in the Texas Panhandle, B. E. Rothgeb.....	636
Bulletin 977, Marketing Hay at Country Points, H. B. McClure and G. A. Collier.....	129
Bulletin 978, The Weighing of Market Hay, G. A. Collier and H. B. McClure.....	228
Bulletin 979, Marketing Hay through Terminal Markets, G. A. Collier and H. B. McClure.....	130
Bulletin 980, Inspection and Grading of Hay, H. B. McClure and G. A. Collier.....	228
Bulletin 981, Sudan Grass and Related Plants, H. N. Vinall and R. E. Getty.....	441
Bulletin 982, Market Statistics.....	290
Bulletin 984, The National Influence of a Single Farm Community, E. F. Hoag.....	386
Bulletin 985, A System of Accounting for Cotton Ginneries, A. V. Swarthout and J. A. Bexell.....	291
Bulletin 986, Studies on the Biology and Control of Chiggers, H. E. Ewing.....	255
Bulletin 987, Handbook of Foreign Agricultural Statistics.....	293
Bulletin 988, Heat Production of Honeybees in Winter, R. D. Milner and G. S. Demuth.....	254
Bulletin 989, Pine-oil and Pine-distillate Product Emulsions: Method of Production, Chemical Properties, and Disinfectant Action, L. P. Shippen and E. L. Griffin.....	178
Bulletin 990, Preliminary Manufacturing Tests of the Official Cotton Standards of the United States for Color for Upland Tinged and Stained Cotton, W. R. Meadows and W. G. Blair.....	133
Bulletin 991, Crop Rotation and Cultural Methods at Edgeley, N. Dak., J. S. Cole.....	130
Bulletin 992, Walnut Husk Maggot, F. E. Brooks.....	249
Bulletin 993, The Composition of California Lemons, E. M. Chace, C. P. Wilson, and C. G. Church.....	140
Bulletin 994, Methods of Conducting Cost of Production and Farm Organization Studies, F. W. Peck.....	291
Bulletin 995, The Beet-sugar Industry in the United States in 1920, C. O. Townsend.....	134
Bulletin 996, Flushing and Other Means of Increasing Lamb Yields, F. R. Marshall and C. G. Potts.....	170
Bulletin 997, The Cost and Utilization of Power on Farms Where Tractors Are Owned, H. R. Tolley and L. A. Reynoldson.....	383
Bulletin 999, Prices of Farm Products in the United States, G. F. Warren.....	192
Bulletin 1000, Labor and Material Requirements of Field Crops, L. A. Moorhouse and O. A. Juve.....	493
Bulletin 1001, The Relation of Land Tenure to the Use of the Arid Grazing Lands of the Southwestern States, E. O. Wooton.....	784
Bulletin 1002, Open Types of Public Markets, McF. Kerbey.....	492
Bulletin 1003, The Distillation of Stumpwood and Logging Waste of Western Yellow Pine, M. G. Donk, C. H. Shattuck, and W. D. Marshall.....	312, 341

Bulletin 1006, Accounting Records for Sampling Apples by Weight, J. H. Conn and A. V. Swarthout.....	Page. 391
Bulletin 1008, Rate of Multiplication of the Hessian Fly, W. R. McConnell.....	352
Bulletin 1009, Volume Variation of Bottled Foods, H. Runkel and J. C. Munch.....	468
Bulletin 1011, Effects of Mutilating the Seeds on the Growth and Productiveness of Corn, E. B. Brown.....	827
Bulletin 1013, The Influence of Relative Humidity and Moisture Content of Wheat on Milling Yields and Moisture Content of Flour, J. H. Shollenberger.....	665
Bulletin 1014, Effect of Date of Seeding on Germination, Growth, and Development of Corn, E. B. Brown and H. S. Garrison.....	532
Bulletin 1016, Bionomics of the Chinch Bug, P. Luginbill.....	658
Bulletin 1022, Relation of Initial Temperature to Pressure, Vacuum, and Temperature Changes in the Container during Canning Operations, C. A. Magoon and C. W. Culpepper.....	663
Bulletin 1023, The Relative Toxicity of Strychnin to the Rat, E. W. Schwartz.....	654
Bulletin 1024, Feeding Experiments with Grade Beef Cows Raising Calves, E. W. Sheets and R. H. Tuckwiller.....	675
Bulletin 1025, Studies in the Clarification of Unfermented Fruit Juices, J. S. Caldwell.....	616
Bulletin 1030, Meade Cotton, an Upland Long-staple Variety Replacing Sea Island, G. S. Meloy and C. B. Doyle.....	833
Bulletin 1035, The Red Spider on the Avocado, G. F. Moznette.....	752
Bulletin 1042, Effect of Winter Rations on Pasture Gains of Calves, E. W. Sheets and R. H. Tuckwiller.....	765
Bulletin 1043, Crop Insurance: Risks, Losses, and Principles of Protection, V. N. Valgren.....	787
Bulletin 1047, Farm Mortgage Loans by Banks, Insurance Companies, and other Agencies, V. N. Valgren and E. E. Engelbert.....	786
Bulletin 1048, Bank Loans to Farmers on Personal and Collateral Security, V. N. Valgren and E. E. Engelbert.....	786
Farmers' Bulletin 1201, Motor Trucks on Eastern Farms, H. R. Tolley and L. M. Church.....	87
Farmers' Bulletin 1203, The Angora Goat, G. P. Williams.....	478
Farmers' Bulletin 1207, Milk and Its Uses in the Home.....	60
Farmers' Bulletin 1209, Planting and Care of Street Trees, F. L. Mulford.....	41
Farmers' Bulletin 1210, Measuring and Marketing Farm Timber, W. R. Mattoon and W. B. Barrows.....	237
Farmers' Bulletin 1211, Home Canning of Fruits and Vegetables.....	208
Farmers' Bulletin 1214, Farm Dairy Houses, E. Kelly and K. E. Parks.....	288
Farmers' Bulletin 1218, Beef Production in the Corn Belt, W. H. Black.....	269
Farmers' Bulletin 1219, Floors and Floor Coverings.....	89
Farmers' Bulletin 1220, Insect and Fungus Enemies of the Grape, A. L. Quaintance and C. L. Shear.....	235
Farmers' Bulletin 1221, Standard Varieties of Chickens.—IV, The Ornamental Breeds and Varieties, R. R. Slocum.....	172
Farmers' Bulletin 1224, Wheat Scab and Its Control, A. G. Johnson and J. G. Dickson.....	240
Farmers' Bulletin 1225, The Potato Leafhopper and Its Control, J. E. Dudley, jr.....	153

Farmers' Bulletin 1226, Take-all of Wheat and Its Control, H. B. Humphrey et al.....	Page. 145
Farmers' Bulletin 1227, Sewage and Sewerage of Farm Homes, G. M. Warren	891
Farmers' Bulletin 1228, A Week's Food for an Average Family, C. L. Hunt	666
Farmers' Bulletin 1229, Utilization of Alfalfa, R. A. Oakley and H. L. Westover	531
Farmers' Bulletin 1230, Chimneys and Fireplaces, A. M. Daniels.....	386
Farmers' Bulletin 1231, Drying Crude Drugs, G. A. Russell.....	208
Farmers' Bulletin 1232, Seed Marketing Hints for the Farmer, G. C. Edler	137
Farmers' Bulletin 1233, Tomatoes for Canning and Manufacturing, J. H. Beattie.....	139
Farmers' Bulletin 1235, Game Laws for 1921, G. A. Lawyer and F. L. Earnshaw	151
Farmers' Bulletin 1237, Pineapple Culture in Florida, E. D. Vosbury and J. R. Winston.....	340
Farmers' Bulletin 1238, Laws Relating to Fur-bearing Animals, 1921, G. A. Lawyer and F. L. Earnshaw.....	151
Farmers' Bulletin 1239, Community Bird Refuges, W. L. McAtee.....	456
Farmers' Bulletin 1241, An Improved Method of Making Sugar-beet Sirup, C. O. Townsend and S. F. Sherwood.....	207
Farmers' Bulletin 1242, Permanent Fruit and Vegetable Gardens, W. R. Beattie and C. P. Close.....	537
Farmers' Bulletin 1246, The Peach Borer: How to Prevent or Lessen Its Ravages; the Paradichlorobenzene Treatment, A. L. Quaintance.....	156
Farmers' Bulletin 1251, Standard Varieties of Chickens.—V, The Bantam Breeds and Varieties, R. R. Slocum.....	769
Circular 113, Alfalfa.....	831
Circular 151, Distribution of Cotton Seed in 1921, R. A. Oakley.....	834
Circular 178, Status and Results of Home Demonstration Work, Northern and Western States, 1920, F. E. Ward.....	94
Circular 179, Status and Results of County Agent Work, Northern and Western States, 1920, W. A. Lloyd.....	94
Circular 183, Forest Experiment Stations, E. H. Clapp.....	41
Circular 184, State Laws and Court Decisions Relating to Cattle-tick Eradication, compiled by H. Goding.....	281
Circular 185, Handbook for Campers in the National Forests in California	341
Circular 188, Progress of Barberry Eradication, F. E. Kempton.....	546
Circular 189, The Well-planned Kitchen.....	89
Circular 190, Extension Work among Negroes, 1920, W. B. Mercier.....	297
Circular 191, Use of Explosives in Blasting Stumps, G. R. Boyd.....	85
Circular 192, Status and Results of Boys' and Girls' Club Work, Northern and Western States, 1920, G. E. Farrell.....	393
Circular 193, Fulghum Oats, T. R. Stanton.....	134
Circular 194, Kanred Wheat, J. A. Clark and S. C. Salmon.....	136
Circular 196, Directory of Officials and Organizations Concerned with the Protection of Birds and Game, 1921, G. A. Lawyer and F. L. Earnshaw.....	151
Circular 197, The Credit Association as an Agency for Rural Short-time Credit, V. N. Valgren and E. E. Engelbert.....	388
Circular 198, Government Forest Work in Utah.....	341
Circular 199, Breeding Morgan Horses at the U. S. Morgan Horse Farm, H. H. Reese.....	369
Circular 200, Improvements in Cotton Production, O. F. Cook.....	439
Circular 201, Eradication of the Sweet Potato Weevil in Florida, J. E. Graf and B. L. Boyden.....	462

	Page.
Circular 202, The Migratory Bird Treaty Act.....	555
Circular 203, Statistics of Cooperative Extension Work, 1921-22, E. Merritt.....	597
Circular 204, The Work of the Huntley Reclamation Project Experiment Farm in 1920, D. Hansen.....	724, 767, 771, 793
Circular 205, Cottonseed Mixing Increased by Modern Gin Equipment, W. W. Ballard and C. B. Doyle.....	834
Circular 207, The Paper Dress Form.....	792
Circular 210, Dispersion of the Boll Weevil in 1921, B. R. Coad, E. S. Tucker, W. B. Williams, F. F. Bondy, and R. C. Gaines.....	751
Circular 215, Commercial Control of Citrus Scab, J. R. Winston.....	746
Circular 218, The Occurrence of Diseases of Adult Bees, E. F. Phillips.....	858
Work and Expenditures of the Agricultural Experiment Stations, 1919, E. W. Allen, E. R. Flint, and J. I. Schulte.....	598
Weather, Crops, and Markets, vol. 1:	
No. 1, January 7, 1922.....	596
No. 2, January 14, 1922.....	510, 596
No. 3, January 21, 1922.....	596
No. 4, January 28, 1922.....	596
No. 5, February 4, 1922.....	789
No. 6, February 11, 1922.....	789
No. 7, February 18, 1922.....	789
No. 8, February 25, 1922.....	789
OFFICE OF THE SECRETARY:	
Circular 155, Rules and Regulations of the Secretary of Agriculture under the Food Products Inspection Law of March 3, 1921.....	291
BUREAU OF BIOLOGICAL SURVEY:	
North American Fauna 45, October 28, 1921.....	245
FOREST SERVICE:	
Spanish Terms for Forest Rangers, compiled by W. Shepard.....	341
The Use Book, Grazing Section, 1921.....	542
BUREAU OF MARKETS AND CROP ESTIMATES:	
Pure Seed in Relation to Community Production of Cotton, G. S. Meloy.....	229
Market Reporter, vol. 4—	
No. 13, September 24, 1921.....	91
No. 14, October 1, 1921.....	91
No. 15, October 8, 1921.....	91
No. 16, October 15, 1921.....	91
No. 17, October 22, 1921.....	192
No. 18, October 29, 1921.....	192
No. 19, November 5, 1921.....	192
No. 20, November 12, 1921.....	192
No. 21, November 19, 1921.....	390
No. 22, November 26, 1921.....	390
No. 23, December 3, 1921.....	390
No. 24-26, December 24, 1921.....	496
No. 27, December 31, 1921.....	496
Monthly Crop Reporter, vol. 7—	
No. 10, October, 1921.....	193
No. 11, November, 1921.....	293
No. 12, December, 1921.....	596

BUREAU OF PLANT INDUSTRY:

Inventory of Seeds and Plants Imported July 1 to September 30, 1916	Page.
(No. 48)-----	29
Inventory of Seeds and Plants Imported October 1 to December 31, 1916 (No. 49)-----	29
Wampee, L. Carrier-----	874

BUREAU OF PUBLIC ROADS:

Public Roads, vol. 4—	
No. 5, September, 1921-----	86
No. 6, October, 1921-----	186, 187
No. 7, November, 1921-----	285
No. 8, December, 1921-----	488, 489

BUREAU OF SOILS:

Field Operations, 1917—	
Reconnaissance Soil Survey in California, Central Southern Area-----	213
Reconnaissance Soil Survey in California, Upper San Joaquin Valley-----	17
Field Operations, 1918—	
Soil Survey in Iowa, Madison County-----	422
Soil Survey in Iowa, Marshall County-----	422
Soil Survey in Iowa, Palo Alto County-----	17
Soil Survey in Iowa, Polk County-----	17
Soil Survey in Iowa, Winnebago County-----	214
Soil Survey in Missouri, Chariton County-----	119
Soil Survey in Missouri, Reynolds County-----	214
Soil Survey in Texas, Bowie County-----	18
Soil Survey in Texas, Freestone County-----	119
Field Operations, 1919—	
Soil Survey in Iowa, Adair County-----	118
Soil Survey in Iowa, Mahaska County-----	814
Soil Survey in Louisiana, Sabine Parish-----	815
Soil Survey in Mississippi, Simpson County-----	316
Soil Survey in Nebraska, Banner County-----	18
Soil Survey in Nebraska, Dakota County-----	422
Soil Survey in Nebraska, Redwillow County-----	422
Soil Survey in North Carolina, Moore County-----	815
Soil Survey in Tennessee, Meigs County-----	119

STATES RELATIONS SERVICE:

A Classified List of Projects Carried on by the Agricultural Experiment Stations, 1920-----	297
Food Selection and Meal Planning Charts 1-8, 1921-----	498

WEATHER BUREAU:

National Weather and Crop Bulletin 42, October 18, 1921-----	16
Circular J, Instrument Division, Instructions for the Installation and Maintenance of Marvin Water-stage Registers, with Specifications, R. N. Covert-----	688
Monthly Weather Review—	
Volume 49—	
No. 7, July, 1921-----	115, 116
No. 8, August, 1921-----	115
No. 9, September, 1921-----	618, 619
No. 10, October, 1921-----	618, 619

WEATHER BUREAU—Continued.

Monthly Weather Review—Continued.

Page.

Supplement 17, 1922..... 779

Supplement 18, October 15, 1921..... 17

Climatological Data, vol. 8—

Nos. 5-6, May-June, 1921..... 16

Nos. 7-8, July-August, 1921..... 209

Nos. 9-10, September-October, 1921..... 419

Nos. 11-12, November-December, 1921..... 808

Daily River Stages, vol. 16, 1918..... 688

Daily River Stages, vol. 17, 1919..... 688

SCIENTIFIC CONTRIBUTIONS.¹

Almy, L. H., and E. Field, The Preservation of Fish Frozen in Chilled Brine.—I, The Penetration of Salt.....	664
Alsberg, C. L., Chemical Structure and Physiological Action.....	202
Ashbrook, F. G., The Fur Trade and the Fur Supply.....	655
Ayers, S. H., and C. S. Mudge, Two Organisms of a Commercial Lactic Starter.....	76
Ayers, S. H., P. Rupp, and C. S. Mudge, The Production of Ammonia and Carbon Dioxid by Streptococci.....	274
Bailey, I. M., and M. F. Snyder, A Survey of Farm Homes.....	695
Baker, A. C., The Practical Significance of the Revolution of the Embryo in Aphid Eggs.....	154
Baker, F. S., C. F. Korstian, and N. J. Fetherolf, Snowshoe Rabbits and Conifers in the Wasatch Mountains of Utah.....	447
Ball, C. R., The Value of Research on Grain Crops.....	29
Bates, C. G., First Results in the Stream Flow Experiment, Wagon Wheel Gap, Colo.....	738
Bergman, H. F., The Effect of Cloudiness on the Oxygen Content of Water and Its Significance in Cranberry Culture.....	632
Billings, G. A., and L. G. Howell, A Three-year Farm Management Survey of Truck Farms in Gloucester County, N. J.....	590
Bisset, P., The Late Dr. Walter Van Fleet.....	541
Black, J. D., F. Robotka, and P. L. Miller, Local Cooperative Potato Marketing in Minnesota.....	290
Blake, S. F., Five New Species of <i>Cedrela</i>	644
Blake, S. F., New Plants from Guatemala and Honduras.....	721
Blatherwick, N. R., Neutrality Regulation in Cattle.....	74
Böving, A. G., and A. B. Champlain, The Larva of the North American Beetle <i>Zenodorus sanguineus</i> Say of the Family Cleridae.....	857
Brewster, J. F., and W. G. Raines, jr., The Effect of Some Decolorizing Carbons upon the Color and Colloids of Cane Juice.....	508
Brewster, J. F., and W. G. Raines, jr., The Effect of Varying H-ion Concentration upon the Decolorization of Cane Juice with Carbon.....	508
Brown, E., Labeling of Field Seeds by Seedsmen.....	732
Brown, N. A., A <i>Pestalozzia</i> Producing a Tumor on the Sapodilla Tree.....	150
Burke, H. E., Notes on the Carpenter Worm (<i>Prionoxystus robiniae</i> Peck) and a New Method of Control.....	750
Burke, H. E., Biological Notes on <i>Desmocerus</i> , a Genus of Roundhead Borers, the Species of which Infest Elders.....	856
Busck, A., and C. Heinrich, Life History of <i>Ethmia macelthosiella</i> Busck.....	856

¹ Printed in scientific and technical publications outside the Department.

Campbell, R. E., and W. H. Nixon, Two Mechanical Devices for Controlling Western Cucumber Beetles.....	Page. 856
Cary, C. A., Amino Acids of the Blood as the Precursors of Milk Proteins.....	74
Caudell, A. N., On the Orthopterous Group Phaneropterae (=Scudderidae), with Descriptions of a New Genus and Species.....	559
Chapin, R. M., The Determination of Cresol by the Phenol Reagent of Folin and Denis.....	14
Chase, A., The Linnaean Concept of Pearl Millet.....	721
Church, M. B., and C. Thom, Mold Hyphae in Sugar and Soil Compared with Root Hairs.....	431
Clement, C. E., Some Economic Problems in Milk Handling of Interest to Milk Inspectors.....	175
Clement, C. E., The Milk Inspector and Milk Plant Operation.....	175
Clevenger, J. F., A Report on the Zamia Starch Situation.....	308
Clothier, R. W., Seasonable Variation in Butter-fat Content of Milk in Southern Arizona.....	679
Cobb, N. A., <i>Howardula benigna</i> : A Nema Parasite of the Cucumber Beetle.....	461
Collins, J. F., Note on Resistance of Chestnut to the Blight.....	150
Cook, F. C., Absorption of Copper from the Soil by Potato Plants.....	324
Cook, O. F., Milpa Agriculture, a Primitive Tropical System.....	595
Coville, F. V., The Influence of Cold in Stimulating the Growth of Plants.....	225
Coville, F. V., The Lychee (<i>Litchi chinensis</i>) a Mycorrhizal Plant.....	235
Craighead, F. C., Hopkins Host-selection Principle as Related to Certain Cerambycid Beetles.....	353
Curtis, R. S., F. T. Peden, and F. W. Farley, Wintering and Summer Fattening of Steers in North Carolina.....	269
Cushman, R. A., North American Ichneumon Flies of the Genera Clitopyga and Schizopyga.....	464
Cushman, R. A., The Identity of a Hymenopterous Parasite of the Alfalfa Leaf Weevil.....	857
Cushman, R. A., and A. B. Gahan, The Thomas Say Species of Ichneumonidae.....	254
Dachnowski, A. P., Peat Deposits and Their Evidence of Climatic Changes.....	317
Darrow, G. M., Small Fruit.....	642
Dearing, C., Muscadine Grapes and Grape Products.....	40
Dendinger, W. C., The Accredited Herd Plan, the Tuberculin Tests, and Their Relation to the Practitioner.....	183
Denton, M. C., Use of the Pressure Cooker in the Home.....	257
Denton, M. C., and L. B. Pritchett, Experiments in the Making of Doughnuts of Low Fat Absorption.....	259
Dill, D. B., A Chemical Study of Certain Pacific Coast Fishes.....	466
Dill, D. B., A Chemical Study of the California Sardine (<i>Sardinia caerulea</i>).....	466
Dixon, H. M., Changes in Farm Organization and Farm Practice as Shown by a Study of the Business Side of Farming in Several Sections of the Country.....	892
Doolittle, R. E., The Food and Drugs Act as It Applies to the Adulteration of Grain.....	228
Doolittle, R. E., Botulism Problem in the United States.....	571
Durrell, L. W., and J. H. Parker, The Comparative Resistance of Varieties of Oats to Crown and Stem Rusts.....	144

	Page.
Edwardes, V. P., Proposed Modification of the Sulphite Process.....	808
Ernest, L. B., No Compromise with Bovine Tuberculosis.....	881
Evenson, O. L., Progress Report of Experiments for Developing Methods of Detecting Remade Milk.....	176
Ewing, H. E., New Nearctic Spider Mites of the Family Tetranychidae....	161
Ewing, H. E., A Second Nearctic Species of Protura, <i>Acerentulus bar-</i> <i>beri</i> n. sp.....	255
Ewing, H. E., New Genera and Species of Protura.....	465
Ewing, H. E., Notes on the Occurrence and Distribution of Antarctic Land Arthropods (Springtails and Mites: Collembola and Acarina)....	752
Farr, C. H., Dormancy and Winterkilling of Peach Buds.....	338
Finks, A. J., and C. O. Johns, Studies in Nutrition.—VI, The Nutritive Value of the Proteins of the Lima Bean, <i>Phaseolus lunatus</i>	564
Finks, A. J., and C. O. Johns, Studies in Nutrition.—VIII, The Nutritive Value of the Proteins of Tomato Seed Press Cake.....	564
Fisher, D. F., and C. Brooks, Drought Spot and Related Physiological Diseases.....	452
Fisher, W. S., A New Cerambycid Beetle from California.....	461
Fisher, W. S., A New Cerambycid Beetle from Santo Domingo.....	661
Flebut, A. J., At Close Quarters with the Mealy Bug; Inspection of Grapes an Aid to Preventing Spread in Vineyards.....	658
Flebut, A. J., Controlling the Achemon Sphinx Moth.....	658
Ford, A. L., The Effect of Poison Bran Mash on Grasshoppers and the Lapse of Time between Poisoning and Death.....	657
Ford, A. L., and W. H. Larrimer, Observations on the Attractiveness of Materials Used in Grasshopper Baits.....	657
Ford, A. L., and W. H. Larrimer, Some Factors Influencing the Efficiency of Grasshopper Baits.....	657
Gahan, A. B., A List of Phytophagous Chalcidoidea with Descriptions of Two New Species.....	857
Galpin, C. J., The Non-group Parts of Farm Populations.....	89
Galpin, C. J., The Physical Aspects of the American Farm Home.....	89
Gerry, E., American Storax Production: Results of Different Methods of Tapping Red Gum Trees.....	341
Goldman, E. A., Two New Rodents from Oregon and Nevada.....	456
Goldman, E. A., Two New Skunks of the Genus <i>Conepatus</i>	655
Goucher, E., Rooting Lychee Cuttings by Means of a High Temperature and High Humidity Process.....	235
Greeley, W. B., Forest Resources and Opportunities in Georgia and Other Southern States.....	541
Greene, C. T., Two New Species of Diptera.....	57
Greene, C. T., An Illustrated Synopsis of the Puparia of 100 Muscoid Flies (Diptera).....	661
Haasis, F. W., Relations between Soil Type and Root Form of Western Yellow Pine Seedlings.....	446
Hadley, C. H., The Status of the Work Against the Japanese Beetle....	661
Hall, M. C., Two New Genera of Nematodes, with a Note on a Neglected Nematode Structure.....	151
Hall, M. C., The Use of Carbon Tetrachlorid for the Removal of Hook- worms.....	282
Hall, M. C., Treatments for Removing the Gastrointestinal Parasites of Horses.....	685
Hall, M. C., Carbon Tetrachlorid for Hookworms in Dogs.....	686

Hall, M. C., Cuterebra Larvae from Cats, with a List of Those Recorded from Other Hosts.....	Page. 686
Harlan, H. V., and M. N. Pope, Ash Content of the Awn, Rachis, Palea, and Kernel of Barley during Growth and Maturation.....	329
Harrington, G. T., Physiological Problems in Relation to the Germination of Seeds.....	731
Harter, L. L., and J. L. Weimer, A Comparison of the Pectinase Produced by Different Species of Rhizopus.....	325
Haskell, R. J., The Fiji Disease of Sugar Cane.....	45
Hawkins, L. A., Coloring Citrus Fruit.....	339
Hawkins, L. A., A Physiological Study of Grapefruit Ripening and Storage.....	339
Hedgcock, G. G., and N. R. Hunt, Notes on <i>Peridermium harknessii</i>	150
Hillman, F. H., and H. H. Henry, The Identification of Seed of Italian Alfalfa and Red Clover.....	732
Hiltner, R. S., and L. Feldstein, Composition of Hollyhock Seed and Oil.....	11
Hitchcock, A. S., Floral Aspects of British Guiana.....	222
Hopkins, A. D., Intercontinental Problems in Bioclimatics, with Special Reference to Natural and Artificial Distribution of Plants and Animals.....	114
Howard, L. O., The War Against Insects.....	852
Hubert, E. E., Observations on <i>Cytospora chrysosperma</i> in the Northwest.....	850
Hunt, C. L., Three-cornered Meals.....	256
Hunter, A. C., The Sources and Characteristics of the Bacteria in Decomposing Salmon.....	753
Imes, M., and F. L. Schneider, Experimental Treatment of Cattle to Prevent Oxwarble Infestation.....	684
Jackson, H. H. T., A Mongoose in Kentucky.....	455
Jackson, H. H. T., Two Unrecognized Shrews from California.....	456
Jaenicke, A. J., Forest Insect Problems of the Pacific Slope.....	852
Jamieson, G. S., W. F. Baughman, and D. H. Brauns, The Chemical Composition of Peanut Oil.....	109
Johns, C. O., and A. J. Finks, Studies in Nutrition.—VII, The Nutritive Value of the Proteins of the Adzuki Bean, <i>Phaseolus angularis</i>	564
Jones, D. B., and C. O. Johns, Determination of the Monamino Acids in the Hydrolytic Cleavage Products of Lactalbumin.....	503
Jones, F. R., and W. B. Tisdale, Effect of Soil Temperature upon the Development of Nodules on the Roots of Certain Legumes.....	124
Kearney, T. H., Pollination of Pima Cotton in Relation to the Yield of Seed and Fiber.....	31
Kelley, M. A. R., Test of a Fan System of Ventilation for Dairy Barns.....	587
Kelser, R. A., Equine Infectious Abortion.....	685
Koser, S. A., R. B. Edmondson, and L. T. Giltner, Observations on <i>Bacillus botulinus</i> Infection of Canned Spinach.....	361
Koser, S. A., and W. W. Skinner, Viability of the Colon-typhoid Group in Carbonated Water and Carbonated Beverages.....	754
LaForge, F. B., The Production of Furfural by the Action of Superheated Water on Aqueous Corncob Extract.....	710
Lamon, H. M., and R. R. Slocum, The Mating and Breeding of Poultry.....	272
Lang, H. L., Studies of the Bacterial Flora of Home Canned Vegetables.....	859
Larimer, W. H., Grasshopper and Cricket Repellents.....	657
Larson, C. W., The Dairy Situation of This and Other Countries.....	175
Leach, B. R., Experiments with Hot Water in the Treatment of Balled Earth about the Roots of Plants for the Control of Japanese Beetle Larvae.....	252

Leach, B. R., and J. W. Thomson, Experiments in the Treatment of Balled Earth about the Roots of Coniferous Plants for the Control of Japanese Beetle Larvae.....	Page. 251
Lee, H. A., and H. S. Yates, The Distribution of Pink Disease.....	652
LeFevre, E., The Bacteriology of Sauerkraut and Pickles.....	502
Leighty, C. E., and S. Boshnakian, Genetic Behavior of the Spelt Form in Crosses between <i>Triticum spelta</i> and <i>T. sativum</i>	333
McAtee, W. L., The Periodical Cicada, 1919; Brief Notes for the District of Columbia Region.....	458
McCrory, S. H., Progress of Drainage in the Southern States.....	381
McCrory, S. H., Agricultural Drainage and Its Relation to Malaria Control.....	460
MacLean, J. D., Wood Block Pavement after Fifteen Years of Service.....	780
MacMillan, H. G., A Frost Injury of Potatoes.....	241
MacMillan, H. G., and L. P. Byars, Heat Injury to Beans in Colorado.....	145
Mann, W. M., Three New Myrmecophilous Beetles.....	159
Marbut, C. F., The Contribution of Soil Surveys to Soil Science.....	620
Marlatt, C. L., Protecting the United States from Plant Pests.....	152
Martin, O. B., The Demonstration Work.....	296
Martin, O. B., Home Demonstration Work.....	393
Meadows, W. R., Universal Standards for American Cotton.....	729
Meadows, W. R., and W. G. Blair, Reginned and Cleaned Cotton: Results Obtained from Some Spinning Tests.....	635
Meigs, E. B., Science of Nutrition as a Guide in Practical Feeding.....	871
Meigs, E. B., Milk Secretion as Related to Diet.....	878
Middleton, W., Some Suggested Homologies Between Larvae and Adults in Sawflies.....	464
Miller, F. H., Reclamation of Grasslands by Utah Juniper on the Tusayan National Forest, Arizona.....	542
Morrison, H., Some Nondiaspine Coccidae from the Malay Peninsula, with Descriptions of Apparently New Species.....	351
Moznette, G. F., Insects which Attack the Avocado in Florida.....	351
Moznette, G. F., Some Important Insects which Attack the Avocada in Florida.....	458
Moznette, G. F., Notes on a Destructive Lawn Insect.....	659
Moznette, G. F., Some Insect Problems Confronting the Avocado Grower.....	748
Mulford, F. L., Broad-leaved Evergreen Shrubs for the South.....	843
Munns, E. N., High Temperatures and Eucalypts.....	446
Nelson, E. K., A Rapid Assay Method for the Determination of Ascaridole in Oil of Chenopodium.....	311
Newcomer, E. J., A Thrips Injury to Apples.....	657
Oberholser, H. C., The Migration of North American Birds, XVI, XVII.....	456
Oberholser, H. C., The Migration of North American Birds, XVIII.....	851
Oberholser, H. C., Glimpses of Desert Bird Life in the Great Basin.....	851
Orton, W. A., Vegetable Problems in Diabetic Diets.....	570
Peters, J. G., What Cooperation in Forest Fire Protection Means to Georgia.....	645
Phillips, E. F., The Future of Bee Disease Control.....	752
Phillips, M., Alkali Fusions.—III, Fusion of Phenylglycin-o-carboxylic Acid for the Production of Indigo.....	203
Phillips, W. J., G. W. Underhill, and F. W. Poos, The Larger Corn Stalk-borer in Virginia.....	155
Piper, C. V., The Identification of <i>Berberis aquifolium</i> and <i>B. repens</i>	721
Popenoe, W., The Native Home of the Cherimoya.....	842

	Page.
Potts, R. C., Availability and Usefulness of Dairy Statistics.....	177
Power, F. B., and V. K. Chesnut, The Odorous Constituents of Peaches....	202
Power, F. B., and V. K. Chesnut, The Occurrence of Methyl Anthranilate in Grape Juice.....	207
Rabak, F., Grape-seed Oil.....	613
Ransom, B. H., Synopsis of the Trematode Family Heterophyidae with De- scriptions of a New Genus and Five New Species.....	151
Ransom, B. H., The Prevention of Intestinal Worms in Pigs.....	685
Reed, C. A., Pecan Culture in Florida.....	41
Reynolds, R. V., and R. J. Hoyle, Wood-using Industries of New York....	739
Rhoads, A. S., Studies on the Rate of Growth and Behavior of the Blister Rust on White Pine in 1918.....	851
Roberts, J. W., The Apple Blotch and Bitter Rot Cankers.....	148
Roberts, J. W., Plum Blotch, a Disease of the Japanese Plum, Caused by <i>Phyllosticta congesta</i>	348
Robinson, T. R., The Eustis Limequat, a New Hardy Lime.....	40
Robinson, T. R., The Bud Sport Origin of a New Pink-fleshed Grapefruit in Florida.....	339
Rogers, E. C., Influence of the Period of Transplanting Western White Pine Seedlings upon Their Behavior in Nursery and Plantation.....	142
Rogers, L. A., Bacterial Cultures.—Their Use in Swiss Cheese Making....	772
Rogers, L. A., E. F. Deysher, and F. R. Evans, The Relation of Acidity to the Coagulation Temperature of Evaporated Milk.....	803
Rohwer, S. A., Descriptions of New Philippine Wasps of the Subfamily Pseninae.....	58
Rohwer, S. A., Some Notes on Wasps of the Subfamily Nyssoninae, with Descriptions of New Species.....	160
Rohwer, S. A., and W. Middleton, North American Sawflies of the Sub- family Cladiinae, with Notes on Habits and Descriptions of Larvae....	661
Root, G. A., White Pine Blister Rust Work in Oregon.....	654
Rosenbaum, J., A Macrosporium Foot Rot of Tomato.....	148
Safford, W. E., Datura—An Inviting Genus for the Study of Heredity....	430
Sando, C. E., and H. H. Bartlett, Occurrence of Quercetin in Emerson's Brown-husked Type of Maize.....	125
Sando, C. E., and H. H. Bartlett, Notes on the Organic Acids of <i>Pyrus</i> <i>coronaria</i> , <i>Rhus glabra</i> , and <i>Acer saccharum</i>	308
Sasscer, E. R., Important Insects Collected on Imported Nursery Stock in 1920.....	748
Satterthwait, A. F., Notes on the Food Plants and Distribution of Certain Billbugs.....	560
Schaus, W., New Species of Lepidoptera in the United States National Museum.....	157
Schopmeyer, C. H., A Unit Course in Swine Husbandry.....	898
Schroeder, E. C., The Epidemic and Epizootic Significance of the Different Types of the Tubercle Bacillus.....	683
Schultz, E. S., A Transmissible Mosaic Disease of Chinese Cabbage, Mustard, and Turnip.....	148
Schwartz, B., Hemotoxins from Parasitic Worms.....	379
Schwartz, E. W., Observations upon the Resistance of the Rat to Con- secutive Injections of Strychnin.....	655
Schwarz, E. A., and H. S. Barber, The Specific Names of Two Otorhynchid Weevils of Florida.....	857
Seamans, A. E., Fallow Experiments in South Central Montana.....	830

	Page.
Shamel, A. D., Some Phases of the Problem of the Decline of Old Citrus Orchards.....	642
Shapovalov, M., and H. A. Edson, Blackleg Potato Tuber Rot under Irrigation.....	146
Shaw, R. H., A Rapid Acidity Test for Grading Milk.....	205
Sherman, H. C., and S. L. Smith, The Vitamins.....	863
Sherwood, S. F., A Process of Producing Palatable Sirup from Sugar Beets.....	207
Sieglinger, J. B., Cross-pollination of Milo in Adjoining Rows.....	230
Sievers, A. F., and J. D. McIntyre, Changes in the Composition of Paprikas during the Growing Period.....	501
Skinner, J. J., and F. R. Reid, Nutrient Requirements of Clover and Wheat in Solution Cultures.....	716
Skinner, W. W., Imitation Fruit Juice Beverages.....	113
Smith, R. S., Bacterial Control in Milk Plants.....	175
Snell, W. H., Observations on the Distance of Spread of Aeciospores and Urediniospores of <i>Cronartium ribicola</i>	150
Snodgrass, R. E., The Seventeen-year Locust.....	853
Snyder, T. E., Injury to Structural Timber by Lepidopterous Larvae.....	750
Speare, A. T., Beneficial Fungi in Citrus Groves.....	245
Steece, H. M., Corn Culture among the Indians of the Southwest.....	532
Stiles, G. W., jr., Losses among Sheep in the Rocky Mountain Region.....	883
Stockwell, C. W., The Japanese Beetle Quarantine.....	751
Swingle, W. T., Lack of Winter Dormancy and the Low Zero Point of Growth of the Lychee Limiting Factors in Its Culture in Florida.....	235
Taylor, G. B., The Use of Chlorinated Lime in the Sterilization of Milk Utensils.....	175
Taylor, G. B., Effect of Remade Milk on the Dairy Industry.....	177
Tehon, L. R., Progress in Barberry Eradication in Illinois during 1919.....	546
Thiel, A. F., and F. Weiss, The Effect of Citric Acid on the Germination of the Teliospores of <i>Puccinia graminis tritici</i>	846
Thom, C., and E. LeFevre, Flora of Corn Meal.....	355
Thompson, L., Distribution of Live Stock in South America.....	269
Thompson, S. C., The Grove City Creamery.....	879
Thompson, W. R. and M. C., Studies of <i>Zenillia roseanae</i> B. and B., a Parasite of the European Corn Borer.....	57
Tilley, F. W., Influence of Peptone on Indol Formation by <i>Bacillus coli</i>	180
Turrentine, J. W., and P. S. Shoaff, Potash from Kelp.—IV, Continuous Countercurrent Lixiviation of Charred Kelp.....	23
Van Zwaluwenburg, R. H., <i>Melanotus hyslopi</i> n. sp. (Coleop.).....	461
Veitch, F. P., and I. D. Clarke, Extraction of Oil and Greases from Leather.....	114
Veitch, F. P., and R. W. Frey, Notes on Water Extraction of Leather.....	114
Veitch, F. P., and T. D. Jarrell, The Determination of Available Calcium Oxid in Lime Used for Unhairing Hides.....	114
Veitch, F. P., and T. D. Jarrell, The Water Resistance of Treated Canvas during Continuous Exposure to Weather.....	187
Veitch, F. P., and T. D. Jarrell, The Effect of Atmospheric Humidity on the Determination of Moisture in Leather.....	205
Viehoeffer, A., Interesting Substitutes for Food Products.....	755
Viereck, H. L., A New Species of <i>Habrobracon</i> (Hym., Braconidae).....	58
Vinall, H. N., A Study of the Literature concerning Poisoning of Cattle by the Prussic Acid in Sorghum, Sudan Grass, and Johnson Grass.....	484
Wade, J. S., and A. G. Böving, Biology of <i>Embaphion muricatum</i>	354

Wade, J. S., and P. R. Myers, Observations Relative to Recent Recoveries of <i>Pleurotropis epigonus</i> Walk. (Hym.)-----	Page. 464
Wadley, F. M., Life History of the Variegated Cutworm-----	660
Waggaman, W. H., H. W. Easterwood, and T. B. Turley, Briquetting Mineral Phosphates-----	718
Walker, J. C., and L. R. Jones, Relation of Soil Temperature and Other Factors to Onion Smut Infection-----	345
Wallace, H. C., The Business Man and Our Agricultural Problem-----	595
Warren, G., Relation of Boys' and Girls' Club Work to the Rural Home and Community-----	598
Washburn, R. S., Labor and Material Requirements in the Production of Commercial Field Beans-----	389
Waterman, H. C., and D. B. Jones, Studies on the Digestibility of Proteins in Vitro.—II, The Relative Digestibility of Various Preparations of the Proteins from the Chinese and Georgia Velvet Beans-----	163
Weir, J. R., Note on the Pathological Effects of Blazing Trees-----	150
Weld, L. H., Notes on Certain Genera of Parasitic Cynipidae Proposed by Ashmead, with Descriptions of Genotypes-----	58
Wells, S. D., The Chemical Constitution of Soda and Sulphate Pulps from Coniferous Woods and Their Bleaching Qualities-----	617
Whitney, M., Fundamental Principles Established by Recent Soil Investigations-----	620
Whitney, M., The Origin of Soil Colloids and the Reason for the Existence of this State of Matters-----	809
Wilcox, R. H., Economic Conditions Causing the Two-day Cattle Market at Chicago and the Effect of the Zoning Law-----	894
Williams, O. E., Sandy Ice Cream-----	880
Winston, J. R., Tear Stain of Citrus Fruits-----	453
Yarnell, D. L., The Flow of Water in Drain Tile-----	778
Yarnell, D. L., The Coefficient of Roughness in Corrugated-iron Pipe-----	888
Yeatman, F. W., Jellied Grapefruit Peel or Orange Peel-----	258
Yothers, W. W., Some Fundamentals of Grove Pest Control-----	351
Yothers, W. W., Sulphur Compounds for Rust Mites-----	355
Zook, L. L., Winter Wheat in Western Nebraska-----	837

EXPERIMENT STATION RECORD.

VOL. 46.

JANUARY, 1922.

No. 1.

The study of man and his work is an absorbing subject. To those interested in the product and processes of his work in the domain of science such a study is of surpassing interest, because it discloses the successive steps by which advancement is made in many diverse lines, and it stimulates imagination as to the boundless possibilities which are open. And where can such a study be better made than at the annual gathering of the scientific bodies represented in the American Association for the Advancement of Science? To the visitor of broad sympathies and contacts as well as to the specialist, these meetings are an unusual opportunity and occasions of singular interest.

The Toronto meeting of 1921 was no exception in this respect. Indeed, it was classed as unusually successful, surpassing expectations in attendance and in the high character of its program. And to these were added a friendly campus with spacious and conveniently grouped halls for the meetings, with dormitories for housing many of the visitors, with a social union where all met at the noon interval, and numerous social gatherings which promoted the more human side of the occasion and brought all men upon a common plane.

To the observer it was a great assembly of many minds in many diverse fields, all consecrated alike to the advancement of knowledge, the basis of civilization and material progress, through the agency of science. They came together for conference, for mutual advantage and stimulation. No one could help being lifted up by this association, or avoid a feeling of exultation at the magnitude of interest and the companionship of such a group. It reminded one of the thought so well expressed by a former President of the United States regarding the attitude and position of workers in science. On the occasion of the centenary of the United States Coast and Geodetic Survey, when a representative body had been gathered to review its work and its importance to the Nation, President Wilson said:

"There is something very intensely appealing to the imagination in the intellectual ardor which men bestow upon scientific inquiry. No social advantage can be gained by it. No pecuniary advantage can be gained by it. In most cases no personal distinction can be gained by it. It is one of the few pursuits in life which gets all its momentum from pure intellectual ardor, from a love of finding out

what the truth is, regardless of all human circumstances—as if the mind wished to put itself into intimate communication with the mind of the Almighty itself. There is something in scientific inquiry which is eminently spiritual in its nature. It is the spirit of man wishing to square himself accurately with his environment, not only, but also wishing to get at the intimate interpretations of his relationship to his environment. . . .

“So when I stand in the presence of scientific men I seem to stand in the presence of those who are given the privilege, the singular privilege, the almost contradictory privilege, of following a vision of the mind with open, physical eyes; making real the things that have been conjectural; making substantial the things that have been intangible.”

In the congregation of the sciences at Toronto, the interests of agriculture were unusually well represented. The directors and the workers in the experiment stations were there in goodly numbers. To a surprising degree they came from the country over—from the Gulf States, the Southwest, the Pacific Coast, and the Northwest, as well as from more adjacent States and all parts of the Dominion. And the sciences on which agriculture rests offered many contributions which had direct bearing on the progress of agricultural research. The fact that some of them were in the more advanced reaches of scientific inquiry, while others dealt more essentially with economic and practical applications, broadened the interest and emphasized the interdependence of different groups of workers.

From the long list of subjects and topics bearing on agriculture, one general theme may be mentioned around which much of the discussion naturally turned, namely, the methods and trends in research. This subject is especially worthy of consideration from time to time, since the key note of all forms of inquiry, whether observation, experiment, or investigation, is progress in the means of acquiring accurate information and a clear understanding of its meaning. Such progress implies to increasing degree clarity in developing the content of such large questions as are presented in agriculture, the basis for their simplification into concrete problems which are in the range of study, and the means of contributing to their solution.

As pointed out by one of the speakers, “science progresses above all by changing its point of view”—by developing new conceptions in regard to the nature of problems and explanations of what the data derived through various types of effort actually mean. It was said, furthermore, that “steady advancement in some of the oldest and most common lines of agricultural inquiry rests more largely on the development of methods than on additional experiments or the accumulation of data on the conventional basis.”

The address of the retiring vice president of the Section of Agriculture, by the writer, dealt with the Method of Science in Agriculture, and that of the president of the Society for Horticultural Science, Dr. W. H. Chandler, with the Trend of Research in Pomology. Both, therefore, were quite unconsciously in the same general field, and emphasized the essential elements of progress in the respective subjects. Dr. Chandler's paper was an exceptionally clear presentation of dependence upon the sciences in solving the practical problems in pomology, and hence the importance of combining such studies with the usual field experiments on trees and fruits.

In both of these addresses full appreciation was accorded the various types of effort so long employed, even though they may not deal with the more fundamental phases of inquiry, and attention was called to their great service in enabling development to the point which has been attained. It has usually been impractical and unwise to wait until the fundamentals have been fully worked out before attempting to supply a remedy for a pest or a condition, or a better method of practical procedure. No informed person would deny the great benefit of information which has been admittedly superficial and empirical, or doubt that it has often been quite sufficient for the practical purposes of the time and the place. But as the amount of such work increases a type of inquiry becomes necessary which will aim at securing fundamental facts on which broader and more definite explanations of cause, effects, and relationships can be constructed. The simpler types of work need to be replaced in part by more rigorous methods and by investigation which goes to the heart of problems. It is by the working out of such methods of inquiry that "we build the ladder by which we rise"; and this argues for a type of experimental work which is critical of its methods and conclusions, seeking means of strengthening them and avoiding error or uncertainty.

Both speakers agreed that certain lines of experimentation which have long been prominent and still form a considerable part of the program of agricultural experimentation have failed to fulfill the expectations originally placed upon them. While they have been useful up to a certain point, their continuance is not always marked by a growth of vision reflected in the method, and data are being accumulated after they have ceased to shed new light. Application of this was made by the writer to a wide range of field and feeding experiments which continue to perpetuate inherent limitations or possible sources of error, or which traverse much the same ground in a conventional way, without being supplemented by laboratory studies or other intensive inquiries. The extent to which conventional methods are adhered to, often in anticipation that they will give results which will enable the framing of scientific facts and prin-

ciples, is sufficient to give pause to such effort and larger consideration for other means of advance.

As was pointed out in the address referred to, it is now realized that many of the long-time field experiments with fertilizers, rotations and soil management systems contain inherent difficulties dating back to their beginning which introduce a strong element of doubt at this stage. The condition and previous treatment of the field, indications of irregularity, etc., are often lacking; the number of check plats is usually too small, as is the amount of replication of treatment, and even for comparative purposes the results may be doubtful. Even where chemical, bacteriological, and other laboratory studies have been introduced, too often they are of routine nature and contribute to the mass of accumulated data without shedding additional light.

Indeed, in some cases the nature of these data, conflicting in themselves, adds to the complexity of the situation and makes interpretation even more difficult. Reliance is placed to large extent on crop returns, and the results as published from time to time are frequently little more than a summary of field and laboratory records, with the attempt to derive comparative results. Such summaries more rarely present a critical analysis of the data and their actual meaning, or give rise to new viewpoints which result in simplifying the problem or making the attack more direct. To only a limited extent are underlying soil questions suggested by such experiments being followed up by intensive studies.

This is a frank criticism, and will perhaps not be accepted by all, but it is made after a sympathetic study of the situation in the effort to determine the trend of progress. It should not be understood to apply broadly to field experimentation as a method, but instead to reliance in such large measure upon field results in the study of complex questions in plant nutrition and soil management. The sufficiency of a method can not be forecast, and hence well made plans do not always result in expectations being realized, but the basis of the experimental method is continual adaptation of the procedure in accordance with what the results disclose. If the data do not contribute to the purpose in hand, this needs to be known as soon as possible, for surely there is no object in spending time and effort in the wrong place or on a method which is not adequate to the problem in hand.

The above does not fail to recognize the large amount of attention now being given to fundamental and searching inquiries on the soil, the conditions of plant nutrition and growth, and related subjects. At no period has there been anything comparable to it in amount or character. It illustrates the development of insight into these problems and progress in the method of inquiry which has

followed. The same element of progressiveness in method and outlook may properly be expected in field experiments designed to study fundamental questions. At this juncture they ought not to represent a broadside attack, but a gradual concentration on problems of limited range, supplemented by definitely directed laboratory study. They are themselves a natural source of problems and of materials for more profound inquiries.

The case of many of the feeding experiments was also cited to show the large extent to which comparison of feeds and methods of management on a profit and loss or other practical basis continues to prevail in that field. Many of these experiments contain unchecked sources of possible error too great for safety. Some of the results can be measured quite accurately, while others can only be described. Some are not experimental in a strict sense because they embody so many factors not under experimental control whose probable variations can not be estimated. It is important that experiments of this practical type occupy their proper place, but as was pointed out, in the scheme for investigation they should not take the place of nutrition and other studies based on more permanent factors, or reliance rest too largely on them at this time.

Fortunately the amount of fundamental investigation in relation to stock raising is far larger than it ever has been before, and is on the increase. These researches are disclosing more clearly the functions to be discharged by food, the inherent qualities which account for the observed value or special properties of particular feeds, and the means of measuring the response of the animal with a high degree of accuracy. They are opening up an entirely new field which is giving a new conception of the "balanced ration" and of relationships of feed constituents heretofore little dreamed of.

In pomology, Dr. Chandler called attention to a certain trend away from field experiments. He stated that the results of such experiments were not fully satisfying the hopes of workers, being conflicting and subject to very large experimental error, often equivalent to 50 to 100 per cent. In other words, in some experiments where a given treatment has apparently doubled the yield, it is not certain that this difference is actually attributable to the treatment. On the other hand, workers are being attracted to the physiological field, notably by such work as that of Kraus and Kraybill, and the amount of such investigation represents a quite definite trend in pomology.

This change of emphasis in pomological work was thought to be important and to make for progress. Physiological studies which deal with the nature and response of trees were pronounced especially valuable, since much more must be known about the tree and

its response to various environmental differences before the results of field experiments or of divers practical experience can be wisely interpreted. The need was mentioned, for example, of more exhaustive study of the rest period of plants, especially that part of the period before the leaves fall, beginning sometime after the terminal buds are formed. At this period, even under favorable temperature and moisture conditions, the trees do not respond with new top growth, although evidence indicates that root growth continues. A whole series of questions were suggested as to the effect of conditions on succeeding growth. The effect of fruiting upon the tree also needs more intimate study in order that the nature and response of fruit trees may be more completely understood.

But warning was sounded that in spite of the ultimate value of such fundamental studies in the solution of practical problems, too much should not be expected of them in the way of immediate results. For one thing, such physiological studies must relate to fairly narrow specific questions, and since these questions are interrelated, a complete solution of one general problem can not be reached until the related problems are solved. For this reason, it is often dangerous to base practical recommendations upon a fundamental conclusion until the manner in which it may be modified by other fundamental factors is well understood.

Dr. Chandler suggested as probable that "the more fundamental the problem studied, the greater is the danger of misinterpretation." For this reason, he was disposed to encourage also studies which might be classed as less fundamental in that they did not aim first at the reasons and a thorough understanding of the principles, but dealt with more empirical conclusions; and he pointed to much of the work in combating insect pests and plant diseases as being of that nature, and also experiments and observations in regard to winter injury, cultural practice, etc. He held that "any truth about the tree is worth seeking, whether the information sought concerns merely the responses to some change in environment, or is the deeper explanation of some such response."

This feeling led him to believe that we are not ready to drop the field experiment. The contribution of this class of experiments has been large. In future, however, he prophesied that field experiments will be of a different nature. For example, the problems to be studied by that means will be more limited in scope; this will apply to work on tillage and cultivation, pruning, and other important features. Moreover, in planning field experiments greater consideration will be given to the nature of the tree, rather than merely to the formal cultural operation; and experiments in the field will be conducted "with very much more care than was thought necessary at the time the earlier field experiments were planned. . . . As we narrow the

problems down to questions involving more minute details of orchard practices, we must so refine our experimental methods that smaller differences will be significant."

In other words, the experimental error must be reduced by a larger amount of replication, a better knowledge of the variations in the field, the growing of trees under uniform treatment for future experiments, uniformity of pruning, leaving the same number of initial branches of each tree, and otherwise. And studies will be needed under such conditions that the response can be more definitely measured and assigned to the causal factors.

For the future Dr. Chandler expressed the view that "field experiments that are to have more than local significance must be in reality physiological studies. That is, they must result in terms of responses peculiar to the tree rather than merely comparisons of practices." This is an important point. The tendency has been to construct experiments which in themselves gave only comparative results without showing the nature of the response, and this has led to difficulty in generalization or in interpreting divergent practical experience. Dr. Chandler accordingly recommended that as far as possible there should be associated with field experiments special physiological or chemical studies conducted with the hope of explaining fundamentally the responses shown in the field. In this connection it was felt that the pomologist himself must be trained to do much of the work he has generally called upon others to do.

With reference to pot experiments as a means of growing trees under controlled conditions, a caution was voiced as to the difficulty of securing normal growth, and the avoidance of handicapping rather than controlling the growth. While such experiments have their place, Dr. Chandler believes they can not replace field experiments and that results secured from them must be applied to practical conditions with great caution, since the response in the field may be quite different. This is true, of course, of experiments with other classes of crops under artificial or abnormal conditions. They are a means for studying reactions under defined conditions, but generalizations from them need to be guarded until tested in the field.

On the program of the American Society of Agronomy several speakers discussed the attainment of accuracy in field experiments, physiological considerations in fertilizer experiments, the method of utilizing soil surveys, the value of soil experiment fields, and similar matters. In their effort to establish values and account for differences developed in field work, these supplemented the interesting contribution of Prof. C. A. Mooers in his presidential address before that society at New Orleans last November.

Dealing with the no less prosaic subject than variety tests, Prof. Mooers applied scientific analysis to such tests made under divergent conditions, with a view to placing agronomic knowledge of varieties on a scientific basis. His study developed several new points of view regarding comparisons of varieties under given conditions, and especially with reference to the existence of a definite relation of variety yields to soil fertility. These relationships were suggested as capable of wide application to garden and orchard varieties as well as to field crops. This paper illustrates the opportunity for close study of field data with a view to disclosing other facts than the more obvious, superficial results.

For the most part, experiments and determinations are relatively easy to make once the procedure has been worked out and is closely followed, and they require the least amount of effort. But their correct interpretation is often difficult, and if they are used as constructive steps in investigation, study and theorizing regarding them is necessary to plan further steps. It is this interpretation and theorizing which gives scope to the originality and research quality of the effort.

Field and feeding experiments represent large annual expenditures, at a time when funds are exceedingly low, and they occupy the time of a large body of workers when productive workers are all too scarce. The maintenance of the proper balance of effort is therefore an important matter of policy for those charged with the administration of research. Some problems, or stages of them, call more urgently for the full measure of the method of science than others, but the investigator can not fail to exercise a critical attitude toward his work and his methods, and to exemplify in them the element of real progress.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

Methods of organic chemistry.—I, General, edited by J. HOUBEN (*Die Methoden der Organischen Chemie. I, Allgemeiner Teil. Leipzig: Georg Thieme, 1921, vol. 1, 2. ed., rev. and enl., pp. XXVI+1121, pls. 2, figs. 730*).—The second edition of Weyl's *Die Methoden der Organischen Chemie* (E. S. R., 29, p. 801) is to be published in four volumes, of which this is the first.

The chemists' yearbook, 1921, edited by F. W. ATACK and L. WHINYATES (*Manchester, Eng.: Sherratt & Hughes, 1921, 6. ed., vols. 1, pp. [6]+422, figs. 11; 2, pp. [4]+423-1142, figs. 15*).—The principal revisions of agricultural interest in the sixth edition of this yearbook (E. S. R., 44, p. 501) have been in the section on Cellulose, by C. F. Cross.

Chemistry of the enzymes.—I, General chemistry of the enzymes, H. EULER (*Chemie der Enzyme. I, Allgemeine Chemie der Enzyme. Munich: J. F. Bergmann, 1920, pt. 1, 2. ed., rev. and enl., pp. [XI]+307, pl. 1, figs. [38]*).—The development of enzyme chemistry during the 10 years since the first edition of this book (E. S. R., 24, p. 608) has made advisable the arrangement of the revised edition in two parts, the first consisting of a general survey of the present state of enzyme chemistry, and the second, to be published shortly, of the preparation and properties of special enzymes. The chapter headings of the present volume are as follows: General discussion of the preparation, purification, and preservation of enzyme preparations and their characterization; enzymes as electrolytes; enzymes as colloids; general chemical kinetics of enzyme reactions; secondary catalyzers and enzyme destroyers; influence of temperature and radiation on enzyme reactions; equilibrium and endpoints of enzyme reactions; enzymatic synthesis; heat, tone, and energy exchange in enzymatic processes; specific action of enzymes; and enzyme formation in the living cell.

The literature references are given as footnotes.

The formation of colloids, T. SVEDBERG (*London: J. & A. Churchill, 1921, pp. VIII+9-127, figs. 22*).—This is the first of a series of small monographs planned by the author with a view to presenting a survey of the chemistry and physics of colloids by a separate treatment of the different phases of the subject. The present monograph gives a survey of the processes which cause the formation of colloids, especially with regard to the conditions which determine the degree of subdivision of the systems formed.

Anaphylaxis reactions with purified proteins from milk, H. G. WELLS and T. B. OSBORNE (*Jour. Infect. Diseases, 29 (1921), No. 2, pp. 200-216*).—Following a summary of the literature on immunological experiments with milk and milk proteins, the authors present the results of anaphylaxis reactions in guinea pigs of the four proteins of milk—casein, lactalbumin, lactoglobulin, and the alcohol-soluble protein described by Osborne and Wakeman (E. S. R., 38, p. 611). The anaphylaxis test showed these four proteins to be immunologically distinct. Only one, the globulin, sensitizes to beef serum or causes

reactions in animals sensitized to beef serum. This indicates that bovine lactoglobulin is chemically identical with the globulin fraction of beef serum, and is a confirmation of the observation of Crowther and Raistrick that lactoglobulin and serum globulin are indistinguishable by chemical tests (E. S. R., 37, p. 8).

The work is thought to demonstrate further the value of immunological methods in preparing proteins in a highly purified state and in furnishing information concerning the chemical relations of proteins from different sources.

Preparation of galactose, E. P. CLARK (*Jour. Biol. Chem.*, 47 (1921), No. 1, pp. 1, 2).—A method of preparing galactose which is said to give more uniform results and a higher yield at a lower cost than the methods usually employed is described as follows:

Lactose is dissolved in hot water containing concentrated sulphuric acid in the proportions of 1,500 gm. of lactose, 3,750 cc. of water, and 75 gm. of concentrated sulphuric acid. After the solution has been heated to boiling and allowed to simmer for two hours, a thin paste of barium carbonate is added to the hot solution until it reacts neutral to Congo paper. After standing over night to allow the precipitate of barium sulphate to settle, the supernatant liquid is drawn off and filtered through a thin layer of active carbon placed on moistened filter paper in a Buchner funnel, when the precipitate is placed on the filter and drained as dry as possible with a final washing with a small amount of water. The filtrate is concentrated under diminished pressure to a weight of 1,650 gm., the resulting thick sirup, which should have a refractive index of between 1.5120 and 1.5125, is warmed to 60 or 70° C., and 250 cc. of ethyl alcohol is dissolved in it with vigorous shaking. The solution is poured into a beaker and the remaining sirup washed from the flask into the beaker with 500 cc. of methyl alcohol added in small amounts. After mixing, the solution is seeded with pure galactose crystals and allowed to stand for about four days to complete the crystallization.

The crude galactose thus obtained is filtered off, washed with a little methyl alcohol, then with 85 per cent ethyl alcohol, and finally with 95 per cent alcohol and dried. It can be further purified by dissolving in water to a 25 per cent solution, adding a few cubic centimeters of glacial acetic acid, concentrating under diminished pressure, warming to 60 or 70°, and adding 95 per cent alcohol to saturation. After having stood over night the crystallized product is filtered off, washed, and dried.

A study of the catalase reaction, S. MORGULIS (*Jour. Biol. Chem.*, 47 (1921), No. 2, pp. 341-375, figs. 13).—The author reports an extensive study of the factors governing the catalase reaction, the results of which have led to the conclusion that "the entire method of comparing several samples of catalase on the basis of the amount of oxygen which they respectively liberate from hydrogen peroxid is of questionable accuracy. The comparison should instead be made between respective quantities of catalase preparation required to set free the same amount of oxygen from a given quantity of hydrogen peroxid. It is further advisable to adjust the reaction to follow some definite course (a 75 per cent decomposition of the hydrogen peroxid is a very good basis). Although the oxygen formation is a linear function of the quantity of catalase, this rule does not hold true when either the catalase or the hydrogen peroxid is in great excess. When, however, the catalase is varied to produce a certain degree of decomposition with the same quantity of peroxid, the catalase strengths will be inversely proportional to the quantities used for the tests. The method of estimating the catalase strength followed in most investigations on catalase is so crude and untenable from a chemical standpoint that one naturally is reluctant to accept the conclusions drawn from those researches, especially where the conclusions are of far-reaching significance."

Methods of extracting and concentrating vitamins A, B, and C, together with an apparatus for reducing milk, fruit juices, and other fluids to a powder without destruction of vitamins, J. F. McCLENDON (*Jour. Biol. Chem.*, 47 (1921), No. 2, pp. 411-420, figs. 4).—A brief description is given of methods devised by the author for the preparation of concentrated products containing vitamins A, B, and C, with one predominating.

"The unique features of the methods are believed to be, first, the extraction of vitamin A from green leaves or fruit skins by the use of high pressure (after moistening with alcohol); second, the separation of the resinous and lipid material from the water-soluble portion in extracting vitamin B by increasing the H-ion concentration up to the isoelectric point of these colloids; and third, the removal of the sugars from the B and C extracts by fermentation with baker's yeast. All processes are carried out in the absence of oxygen, and the drying is done very quickly."

The apparatus used in drying the products is described and illustrated.

The differential dialysis of the antineuritic and the antiscorbutic factors, S. S. ZILVA and M. MIURA (*Biochem. Jour.*, 15 (1921), No. 3, pp. 422-426, figs. 2).—As tested by feeding experiments with rats and guinea pigs, respectively, the vitamin B of autolyzed yeast juice and the vitamin C of decitrated lemon juice were found to diffuse through membranes of such permeability as permit the passage of substances of the molecular dimensions of methylene blue, neutral red, and safranin, while membranes of lower permeability did not permit the diffusion of these substances. "It is suggested that the active molecules whether simple or associated may be of a semicolloid nature."

Structure and significance of the phosphatids, P. A. LEVENE and I. P. ROLF (*Physiol. Rev.*, 1 (1921), No. 3, pp. 327-393).—This review records recent progress in the study of the three phosphatids lecithin, cephalin, and sphingomyelin, under the topics preparation, structure, and biological aspects. An extensive bibliography is appended.

Composition of hollyhock seed and oil, R. S. LILTNER and L. FELDSTEIN (*Jour. Indus. and Engin. Chem.*, 13 (1921), No. 7, p. 635).—Data on the composition of hollyhock seed and oil are contributed from the Denver office of the Bureau of Chemistry, U. S. Department of Agriculture. The composition of mature seeds thrashed from pods of different varieties is reported as follows: Moisture 4.4 per cent, crude protein 21.2, ether extract 11.9, starch 9.1, crude fiber 25.6, and ash 6.9 per cent. The ether extract, which resembled raw linseed oil in color, showed the following properties: Refractive index at 25° C. 1.4722, specific gravity 15.6°/15.6° 0.9275, and iodine number 119. The oil gave a strong Halphen test and responded positively to Bechi's test, showing that these tests are not distinctive of cottonseed oil exclusively and furnishing additional evidence that the Halphen test is peculiar to the oils from the seeds of plants belonging to the Mallow family (Malvaceae) and the related Bombax family (Bombaceae).

"It is doubtful if hollyhock oil will ever be an article of commerce, as the seed contains less than 13 per cent of oil, about half as much as is contained in cotton seed. On account of the quantity of ether extract and protein present, however, the seed might serve some useful purpose as a feeding stuff. While it is very light and bulky, individual plants seem to yield heavily, an average of about 100 gm. of seed per plant being obtained from six plants."

Symposium on drying (*Jour. Indus. and Engin. Chem.*, 13 (1921), No. 5, pp. 427-460, figs. 55; 7, pp. 600-605, figs. 5).—The following papers were presented at a symposium on drying before the Division of Industrial and Engineer-

ing Chemistry at the meeting of the American Chemical Society, Rochester, N. Y., in April, 1921:

The Rate of Drying of Solid Materials, by W. K. Lewis (pp. 427-432); The Theory of Atmospheric Evaporation—With Special Reference to Compartment Driers, by W. H. Carrier (pp. 432-438); The Compartment Drier, by W. H. Carrier and A. E. Stacey, jr. (pp. 438-447); The Spray Process of Drying, by R. S. Fleming (pp. 447-449); Direct Heat Rotary Drying Apparatus, by R. G. Merz (pp. 449-452); Tunnel Driers, by G. B. Ridley (pp. 453-460); and Vacuum Drying, by C. O. Lavett and D. J. Van Marle (pp. 600-605).

The comparative values of decolorizing carbons, F. E. THOMAS (*Internatl. Sugar Jour.*, 23 (1921), No. 267, pp. 162-165).—The author points out the inaccuracy involved in basing the efficiency of decolorizing carbons on the comparative decolorizing effects of equal weights of different carbons, and suggests instead a comparison of the relative quantities of different carbons required to effect the same decolorization. The suggested standard method of evaluating carbons is as follows:

The standard for comparison is a raw sugar solution dissolved to 50° Brix and just on the acid side of neutrality. To one portion of the sugar solution 5 per cent of Norit is added in the cold, the solution brought to boiling and filtered, and the first half of the filtrate returned to the original solution and filtered again to eliminate the free particles which come through first. The amount of the carbon under examination which will give the same decolorization as that obtained with the Norit is then determined by following the same technique with varying amounts of the unknown carbon.

The microdetermination of nitrogen and its biological applications, M. POLONOVSKI and C. VALLÉE (*Jour. Pharm. et Chim.*, 7. ser., 24 (1921), No. 4, pp. 129-134, fig. 1).—This paper consists principally of a description of a modified apparatus for the microdetermination of nitrogen by the Folin colorimetric method.

Determination of ammonia nitrogen in complex fertilizers composed of calcium cyanamid and ammonium salts, J. FROIDEVAUX and H. VANDENBERGHE (*Ann. Chim. Analyt.*, 2. ser., 3 (1921), No. 5, pp. 146-151, figs. 2).—In place of the customary method of determining ammonia nitrogen in mixed fertilizers containing calcium cyanamid by distillation in the presence of magnesia, the authors recommend distillation with concentrated sodium hydroxid in the cold, with aspiration to facilitate the collection of ammonia in the standard acid. The apparatus consists of a cylindrical flask with a three-hole stopper, connected on one side with the receiving flask by means of glass tubing so bent as to prevent the possibility of the sodium hydroxid passing over into the receiving flask, and on the other with a flask containing sulphuric acid to absorb ammonia from the air. The sodium hydroxid is introduced into the flask through a separatory funnel, and the flask is set in ice to prevent too rapid action. When one determination is to be made the receiving flask is connected with the aspirator by means of an empty bottle. The apparatus may also be set up in battery form alternating the distillation and receiving flasks, and having at the end opposite the aspirator the flask containing the acid solution to absorb ammonia from the air and at the end nearest the aspirator the empty flask.

Meat extracts and their substitutes, especially the determination of the nitrogen compounds contained therein, K. BECK and E. MERRES (*Arch. Reichsgesundtsamt.*, 52 (1920), No. 2, pp. 223-252).—Analyses are reported of various commercial and home-prepared meat extracts and vegetable substitutes, particularly as regards the nitrogen distribution.

The maximum, minimum, and average values for total nitrogen were 7.8, 9.8, and 8.5 per cent, respectively; for ammonia nitrogen 0.33, 0.41, and 0.37; amino acid nitrogen 1.0, 1.5, and 1.3; and total creatinin 3, 6.7, and 5.3. The minimum and maximum values for ash were 17 and 25, chlorin calculated as NaCl 2 and 10, and moisture 16 and 26 per cent. From two-thirds to three-fourths of the nitrogen was precipitated by phosphotungstic acid. On hydrolysis the content in ammonia nitrogen was doubled and amino acid nitrogen tripled.

The vegetable extract differed from the meat in a much smaller total nitrogen content, a higher ratio of amino acid nitrogen to total nitrogen, absence of creatinin and creatin, and a high content of ash and chlorin.

For the detection of gelatin in meat extract, the method described by Striegel¹ for the determination of gelatin in protein-containing feeds was used. This consists in dissolving the gelatin, amids, and water-soluble proteins by heating with dilute tartaric acid, precipitating the albumoses and acid albumin with copper or zinc sulphate, filtering, precipitating the gelatin with tannin, and finally determining the nitrogen of the precipitated gelatin by the Kjeldahl method. A home-prepared meat extract gave a high percentage of gelatin by this method, thus indicating that a high gelatin content does not necessarily mean added gelatin.

Note on a chemical test for cassava and rice flour, L. DESVERGNES (*Ann. Chim. Analyt.*, 2. ser., 3 (1921), No. 7, pp. 205-208).—The author states that it is possible to detect the presence of rice or cassava flour in wheat flour by the following test:

Ten gm. of the flour is placed in a 200 cc. flask, 45 cc. of 95 per cent alcohol and 5 cc. of concentrated hydrochloric acid are added, and the mixture is boiled under a reflux condenser for 5 minutes. After cooling the liquid is filtered and shaken with benzine and water in the proportion of 50 parts of the former and 25 of the latter to 100 of the filtrate. A deep rose color in the alcohol solution denotes the presence of cassava or rice flour.

Apparatus for the routine determination of melting points of fats and fatty acids, S. H. BLICHFELDT and T. THORNLEY (*Analyst*, 46 (1921), No. 542, pp. 180-182, fig. 1).—The melting point in the method described is defined as the temperature at which a column of fat of specified dimensions begins to move in an open tube of specified dimensions under a definite hydrostatic pressure. Clean glass tubes 6.5 cm. long, 1 mm. bore, and 3 mm. diameter are immersed in the melted mixed sample and the fat allowed to rise just over 1 cm. in the tubes, after which the tubes are withdrawn and the lower ends placed upon filter paper until the column of melted fat is reduced to exactly 1 cm. in length. The tubes are then placed between two blocks of ice for two hours for complete solidification of the fat, after which they are fixed vertically in a water bath capable of being heated slowly and regularly with constant stirring. The tubes are adjusted so that the upper surface of the fat is 1 cm. below the level of the water. The water is then heated so that the temperature rises 1° C. per minute, and the temperature at which the fat begins to slide up the tube is noted as the melting point. An illustration is given of an apparatus adapted for the simultaneous determination of the melting points of a number of samples by this technique.

The detection of adulteration in butter by means of the melting point of the insoluble volatile acids, G. VAN B. GILMOUR (*Analyst*, 46 (1921), No. 542, pp. 183-187, fig. 1).—The capillary tube method for determining melting points described above has been used to determine the melting points of the insoluble volatile acids obtained from butter, coconut fat, and palm kernel fat

¹ Chem. Ztg., 41 (1917), No. 44-45, pp. 313, 314.

by the use of the Blichfeldt distillation apparatus previously described (E. S. R., 41, p. 412).

The melting points of the insoluble volatile acids of samples of pure butters were found to lie between 15.8 and 25.6° C. Samples with low distillation figures, as determined according to the author's method (E. S. R., 43, p. 315), in general were found to have high melting points and vice versa. A sample of coconut fat gave a melting point (insoluble volatile acid) of 9.9°, and palm kernel fat one of 21.2°. In most of the mixtures of butter with coconut or palm kernel fat the melting point of the acid fell below 15.8°. In those cases in which the melting points were above 15.8°, the total volatile acid figures were below 28. It is thought that the melting point determination will be useful as a confirmatory test in the analysis of butter fat when taken in conjunction with the figure representing the total volatile acids.

The detection of cocoa butter in butter, R. MEURICE (*Ann. Chim. Analyt.*, 2. ser., 3 (1921), No. 5, pp. 143-145).—The author suggests for the detection of cocoa butter in butter the determination of the index of fixed acidity. This is obtained by first separating the fixed insoluble acids as in the determination of the Hehner number, dissolving them in alcohol, and titrating with normal sodium hydroxid, the results being expressed in cubic centimeters of normal NaOH per 100 gm. of fat. While cocoa butter and butter have average Hehner numbers of 87.2 and 87.02, respectively, the corresponding indices of fixed acidity are 416.9 and 338. The method proposed is said to permit the detection of 5 per cent of cocoa butter in butter.

The Bömer method for the detection of suet in lard, VITOUX and C. F. MUTTELET (*Ann. Chim. Analyt.*, 2. ser., 3 (1921), No. 7, pp. 208-212).—Previously noted from another source (E. S. R., 45, p. 315.)

The determination of cresol by the phenol reagent of Folin and Denis, R. M. CHAPIN (*Jour. Biol. Chem.*, 47 (1921), No. 2, pp. 309-314).—An application of the Folin-Denis colorimetric method for the determination of cresol to the determination of phenolic preservatives in serums, etc., has been developed by the author at the Bureau of Animal Industry, U. S. Department of Agriculture, as follows:

To 1 cc. of the serum in a 300-cc. flask are added 125 cc. of water, 4 cc. of 1:3 (by volume) sulphuric acid, 4 cc. of a 10 per cent solution of silicotungstic acid, and a fragment or two of hot pumice. The flask is connected to a nearly vertical condenser by a three-bend tube, the contents slowly heated to boiling, and the distillate collected in a 200-cc. volumetric flask until the latter is half full. The flame is then temporarily withdrawn, 100 cc. or more of water is added to the distilling flask, and the distillation is continued until the receiver is filled nearly to the mark. After bringing the distillate to the mark with water, 20 or 50 cc., depending upon whether phenol or cresol is the preservative probably used, is transferred to a 100-cc. flask, mixed with 3 cc. of the phenol reagent prepared by the formula of Wu (E. S. R., 44, p. 112), and diluted to 63 cc., after which 5 gm. of pure powdered sodium bicarbonate is added and the flask is swirled for about two minutes or until solution is complete. The flask is allowed to stand one-half hour for complete inactivation of excess reagent and the contents then made to volume, mixed, and filtered, the first 27 cc. of the filtrate being discarded. Colorimetric determinations are then made in the Duboseq colorimeter, the standard phenol being set at 20 and first read against itself.

A table is given of the color factors $\frac{\text{weight of cresol}}{\text{weight of phenol}}$ for each of the three cresols and for commercial cresol.

A rotary digester for use in bagasse analysis, G. L. SPENCER (*Jour. Indust. and Engin. Chem.*, 13 (1921), No. 7, p. 640).—To facilitate the testing of bagasse for sugar, the author has devised a rotary digester which is essentially a steam bath in which cylinders containing the sample and water are rotated. Specifications for the apparatus and details of its operation are presented.

[Standards for canned goods] (*Natl. Cannery Assoc. Bul.* 82-A (1921), pp. 11).—This publication gives the tentative definitions and standards for canned corn, tomatoes, and tomato products proposed by the joint committee on definitions and standards of the Bureau of Chemistry, U. S. Department of Agriculture, together with proposed definitions and standards for canned peas, and certain miscellaneous standards.

[Inspection service] (*Natl. Cannery Assoc. Bul.* 8-I (1920), pp. 23).—This bulletin outlines the organization and inspection rules of the National Cannery Association, and announces tentative minimum standards for certification of various canned products.

The industrial utilization of the potato, A. E. HARRIS (*Jour. Roy. Agr. Soc. England*, 81 (1920), pp. 103-110).—This is a general discussion of the possibility of commercial utilization of potatoes for the manufacture of potato flour, starch, and by-products, with brief descriptions of the manufacturing processes involved.

Discoloration in canned sweet potatoes, E. F. KOHMAN (*Jour. Indust. and Engin. Chem.*, 13 (1921), No. 7, pp. 634, 635).—An investigation of the cause of black discoloration in canned sweet potatoes has led to the conclusion that it is the result of the combination of a tanninlike substance in the sweet potatoes with iron from the can. As the reaction requires iron in the ferric state involving the presence of oxygen, the necessity of tight seams in the can is emphasized. While the substance involved in the discoloration is localized largely just under the peel, it is sufficiently scattered through the potato particularly after steaming, to make it impossible to avoid the darkening by removing a thicker peel.

METEOROLOGY.

Organization of the Agricultural Service of Applied Meteorology in Italy, G. AZZI (*Bol. Unione Cattedre Ambul. Agr. Ital.*, 1 (1919), No. 2, pp. 1-12; *abs. in Internatl. Inst. Agr. [Rome], Internatl. Rev. Sci. and Pract. Agr.*, 11 (1920), No. 2, pp. 144-146).—This is a description of the network of agricultural stations of applied geography and meteorology organized by the author under the auspices of the Italian Agricultural Society and in operation since the season of 1918.

The plan includes systematic observations on the growth and condition of wheat at different stages and on the accompanying meteorological conditions, the objects being to find reliable data to serve as a basis for (1) selecting from the different varieties of wheat the one best suited to a given district, (2) fixing the best date for sowing and other operations so as to make the critical periods coincide with the most favorable weather conditions, and (3) aiding in determining ways of combining in the best proportions "specific productiveness" and "resistance to the most harmful meteorological phenomenon." In addition data are also recorded on (1) approximate percentage of total area seeded to wheat, (2) average yield on land of average fertility, (3) morphological characteristics, (4) physiological qualities, (5) land best suited for wheat, (6) land not suited for wheat, (7) adverse meteorological phenomena to which a given variety appears to be specially resistant, and (8) adverse meteorological phenomena to which the variety appears to be particularly susceptible.

Long-period weather forecasts, J. MASCART (*Compt. Rend. Acad. Sci. [Paris]*, 173 (1921), No. 8, pp. 419-421; *abs. in Rev. Sci. [Paris]*, 59 (1921), No. 17, p. 508).—Reviewing the results of predictions based upon the weather during the past three years, the author concludes that the daily predictions have realized an accuracy of 78.3 per cent, while forecasts for a longer period (10 to 41 days) have shown an accuracy of 65.7 per cent.

Climatological data for the United States by sections (*U. S. Dept. Agr., Weather Bur. Climat. Data*, 8 (1921), No. 5, pp. [188], pls. 3, fig. 1; 6, pp. [187], pls. 3, fig. 1).—These volumes contain brief summaries and detailed tabular statements of climatological data for each State for May and June, 1921, respectively.

Seasonal precipitation, March 1 to September 30, 1921 (*U. S. Dept. Agr., Natl. Weather and Crop Bul.*, No. 42 (1921), pp. 4, 6, fig. 1).—A chart is given which "shows the percentage of normal precipitation for the warm season of the current year, March to September, inclusive. It indicates that there was rather marked deficiency in precipitation for the past crop-growing season, as a whole, in portions of the Middle and South Atlantic States, some northern Plains districts, portions of Oklahoma and western Texas, and from Nevada and central California northward, where less than 75 per cent of the normal was received. The totals for the season were above the normal, however, in most of the Mississippi and Ohio Valleys, the central and lower Rocky Mountain districts, and extreme northern Great Plains, as well as in portions of the west Gulf section and the far Southwest. The largest variation from the normal appears in the lower Colorado River Valley, where some localities received nearly five times the seasonal average, but at the same time in some near-by sections the amounts were considerably below normal."

Precipitation and the growth of oaks at Columbia, Mo., W. J. ROBBINS (*Missouri Sta. Research Bul.* 44 (1921), pp. 3-21, pl. 1, figs. 3).—This is a report of a study based upon measurements of the width of rings on oak stumps, covering the period from 1830 to 1919.

It was found that the annual ring width tended to increase to a maximum during the years 1902 to 1910, corresponding to an age of about 100 years for the oaks measured. The yearly variations in the width of the rings for 1890-1919 are correlated inversely with the mean monthly temperatures of May and June, and directly with the precipitation of March, April, May, and June. An especially narrow ring in 1860 is correlated with a low spring rainfall in northern Missouri.

"The annual ring width for the last 30 years has been calculated by means of a formula $G=C \times \frac{P}{T}$ where C =a constant, P =the precipitation for March, April, May, and June in inches, T =the sum of the mean monthly temperatures for May and June, and f =a gradually changing factor. The value of the factor, f , for 1890-94 is approximately 1, for 1895-1900 1.5, for 1901-1906 2, for 1907-1913 1.5, and for 1914-1919 1. . . . The average difference between the calculated and determined annual ring width is 17 per cent, and for the 30 years the difference between the calculated and determined ring width about 5 per cent."

Sulphur supplied to the soil in rain water, B. D. WILSON (*Jour. Amer. Soc. Agron.*, 13 (1921), No. 5, pp. 226-229).—Analyses of water from rain and snow collected at the New York Cornell Experiment Station showed that for two years an average annual amount of 26.19 lbs. per acre of sulphur was supplied to the soil from this source. A summary is also given of similar observations at other points for comparison.

Bibliography on the climate of South America, M. M. WELCH (*U. S. Mo. Weather Rev. Sup. 18* (1921), pp. 42).—This bibliography gives annotated lists of references to articles relating to the climate of South America as a whole and of the different South American countries.

SOILS—FERTILIZERS.

Reconnaissance soil survey of the Upper San Joaquin Valley, Calif., J. W. NELSON ET AL. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1917, pp. 116, pls. 4, fig. 1, map 1*).—This survey, made in cooperation with the California Experiment Station, deals with the soils of an area of 3,283,200 acres, a short distance south of the geographical center of California. It covers the upper or southern part of the Great Interior Valley of California. About three-fourths of the area is included in Kern County, and the remainder is about equally divided between Tulare, Kings, and San Luis Obispo Counties, with a few square miles extending into Santa Barbara County.

The main part of the area consists of an almost level plain terminated rather abruptly by the surrounding hills. The valley is separated from the adjoining mountains along its east and west margins by a rolling foothill belt several miles wide. The valley consists of alluvial fans which increase in gradient as the foothills are approached. The portion of the main valley within the area has no definite drainage outlet, but contains two minor depressions in which practically all the flood waters collect.

The soils of the area are grouped as residual, old valley filling, recent alluvial, lake-laid, and wind-laid soils. Including rough broken land and rough stony land, 44 soil types of 20 series are mapped, of which the Panoche loams and rough broken land cover 13.3 and 11.7 per cent of the area, respectively. It is stated that the soils of the area vary greatly in character, and irrigation is essential to a diversified agriculture. There are said to be between 600 and 700 square miles of land in the area affected by alkali.

Analyses of soils of Wilkes County, W. A. WORSHAM, JR., D. D. LONG, L. M. CARTER, M. W. LOWRY, and W. O. COLLINS (*Ga. Col. Agr. Bul. 225* (1920), pp. 39, figs. 4).—This report supplements the physical survey of the soils of the county (E. S. R., 36, p. 420), and consists of a chemical study of the prevailing soil types. It is shown that the principal upland soils of the county are deficient in nitrogen and phosphoric acid, but that most of them are well supplied with potash.

Soil survey of Palo Alto County, Iowa, A. M. O'NEAL, JR., ET AL. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1918, pp. 36, fig. 1, map 1*).—This survey, made in cooperation with the Iowa Experiment Station, deals with the soils of an area of 359,040 acres in northwestern Iowa. The topography varies from gently undulating to rolling, with a few strongly rolling areas along the western boundary and in the northern part of the extreme northwestern township. Throughout the more rolling sections the natural drainage is said to be good, but is inadequate over the greater part of the county.

The soils are of glacial till, ancient alluvial, lake bottom, recent alluvial, and organic origin. Including peat and muck, 14 soil types of 7 series are mapped, of which the Clarion loam, Webster loam, and Lamoure silty clay loam cover 37.7, 28, and 14.4 per cent of the area, respectively.

Soil survey of Polk County, Iowa, E. H. SMIES ET AL. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1918, pp. 67, fig. 1, map 1*).—This survey, made in cooperation with the Iowa Experiment Station, deals with the soils of an area of 372,480 acres in south-central Iowa. The surface of the area is an even plain, drift covered in the northern three-fourths, and mantled with a

silty material over the remainder. It varies from rolling along the rivers to flat to gently undulating farther inland. The drainage is effected by the Des Moines and Skunk Rivers, and is rather slow on the divides in the northern three-fourths of the county.

The soils of the county are grouped as upland soils derived from glacial drift, upland soils derived from silty material, and alluvial soils derived from reworked drift and silty material. Including riverwash and muck and peat, 33 soil types of 14 series are mapped, of which the Carrington loam, Webster clay loam, and Tama silt loam cover 32.9, 17, and 11.1 per cent of the area, respectively.

Soil survey of Banner County, Nebr., F. A. HAYES and H. L. BEDELL (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1919, pp. 62, fig. 1, map 1*).—This survey, made in cooperation with the University of Nebraska, deals with the soils of an area of 474,880 acres in extreme western Nebraska, lying in the High Plains division of the Great Plains province. The topography varies from flat or gently undulating to rough and dissected. Drainage is said to be generally good throughout the county.

The soils of the county are grouped as residual, colluvial and alluvial fan, alluvial, and wind-blown soils. Including rough broken land and dune sand, 28 soil types of 10 series are mapped, of which the Epping very fine sandy loam, rough broken land, and Rosebud loam cover 20.2, 16.1, and 14.2 per cent of the area, respectively.

Soil survey of Bowie County, Tex., L. R. SCHOENMANN ET AL. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1918, pp. 62, fig. 1, map 1*).—This survey, made in cooperation with the Texas Experiment Station, deals with the soils of an area of 584,960 acres in extreme northeastern Texas. The county is made up of three physiographic divisions, namely, a broad ridge extending east and west through the central part, extensive flats, and alluvial belts. In the central ridge the surface is undulating to gently rolling. The flat belts are prevailingly level, and the river and stream bottoms have a flat and uniform surface.

The Red River receives the drainage from the northern two-fifths of the county and the remainder drains into the Sulphur River. The central ridge belt is said to have fairly adequate drainage. In the flat belts adequate drainage is not provided for any great distance back from the main stream courses. All of the principal drainage ways have developed flood plains.

The upland soils of the county are derived from Coastal Plain material, and the area lies entirely within the Coastal Plain region. Including riverwash, 35 soil types of 18 series are mapped, of which the Susquehanna and Bowie very fine sandy loams cover 18 and 17.5 per cent of the area, respectively.

Aqueous vapor pressure of soils, M. D. THOMAS (*Soil Sci., 11 (1921), No. 6, pp. 409-434, figs. 5*).—In a contribution from the Utah Experiment Station a method of measuring the aqueous vapor pressure lowerings of soil accurately to 0.01 mm. of mercury at 25° C. is described, and a few preliminary results are presented from experiments with sand, silty clay loam, clay loam, and a silty clay separate, showing among other things the influence of adding common alkali salts to one of them.

The vapor-pressure moisture curves are shown to be rectangular hyperbolas over a wide range of moisture contents. This is taken to indicate that the vapor pressure is proportional to the reciprocal of the moisture content. The position of each curve was found to depend almost wholly upon the texture of the soil in the absence of dissolved material.

In a second set of experiments sodium carbonate, sulphate, and chlorid were found to be absorbed by the silty clay loam soil in amounts of from

85 to 90, 70, and from 10 to 44 per cent, respectively, although it was possible to extract the last two salts completely.

Some of the energetic functions of these soils are analyzed in the light of vapor-pressure data and their significance pointed out from this viewpoint. Correlations are thus given between the vapor pressure and the hygroscopic coefficient, wilting coefficient, moisture equivalent, Bouyoucos' "solid water," capillary potential, surface tension, and curvature of the moisture surface. In the case of the moisture equivalent some independent data and calculations are given confirming a portion of the vapor-pressure data.

The fixation of atmospheric nitrogen by inoculated soy beans, E. B. FRED (*Soil Sci.*, 11 (1921), No. 6, pp. 469-477, figs. 5).—The results of a field experiment conducted at the Wisconsin Experiment Station with soy beans on inoculated and uninoculated sand soil to determine the influence of inoculation on nitrogen fixation are reported.

It was found that inoculation increased the yield of soy beans 1,787 lbs. per acre, or more than threefold, and resulted in a net gain in nitrogen of approximately 57 lbs. per acre. At the time of harvest the inoculated soy beans contained 57.1 lbs. of nitrogen in the tops; 2.4 lbs. in the roots, and 5.86 lbs. in the nodules, while the tops of the uninoculated plants contained only 7.46 lbs. and the roots 0.87 lb. Aside from the gain in yield, inoculation caused an increase in the percentage of nitrogen in the tops and roots. Although the entire crop of soy beans above ground was cut and removed, the residual effect of inoculation was clearly shown in the growth of rye the following year, the residue of soy bean roots and nodules greatly benefiting its growth.

Field tests on the inoculation of canning peas, E. B. FRED, W. H. WRIGHT, and W. C. FRAZIER (*Soil Sci.*, 11 (1921), No. 6, pp. 479-491, figs. 4).—Experiments conducted by the Wisconsin Experiment Station are reported, showing that inoculation of a heavy, rich clay loam soil slightly acid, which had been cropped to peas for years, apparently had no effect on the pea crop. With a rich silt loam soil, unlimed and acid, which apparently had not been previously cropped to peas, inoculation caused an increase in the total yield of pea plants, in the yield of peas, and in the percentage of nitrogen. Analyses of this soil showed that there was also a gain in nitrogen in the residual soil where inoculated peas were grown. Inoculation produced similarly favorable results on a fertile heavy silt loam soil with neutral reaction which had been heavily manured for years.

[Soil fertility studies], E. F. GASKILL (*Massachusetts Sta. Rpt.* 1920, pp. 15a-18a).—In the nitrogen studies (E. S. R., 42, p. 326) it was found that significant yields of hay and rowen were obtained from plats which had received no nitrogen in either fertilizer or manure for a period of over 30 years. The records of this series of plats indicate a distinct gain of nitrogen through the growth of leguminous crops. It was again demonstrated that large amounts of commercial nitrogen are somewhat antagonistic to the growth of clovers on these plats.

Potash studies on light loam and heavy silt loam soils showed increases in several crops over a long term of years, but brought out the fact that in one case corn can not grow without added potash, while in the other, liberal quantities of potash fertilizer make scarcely a perceptible difference in the yield of corn. This result is considered significant since in the soil survey these areas are classified together.

Data on the effect of nitrogen, phosphoric acid, and potash on corn and grass are also reported.

Fertilizers, W. NEWTON (*Brit. Columbia Dept. Agr. Bul.* 87 (1921), pp. 16).—General practical information on the functions and proper uses of fertilizers

and manure on British Columbia soils is given, together with a brief explanation of fertilizer formulas, mixing for practical use, and the significance of inspection.

Manures in their relation to present-day South Australian farming, A. J. PERKINS (*Jour. Dept. Agr. So. Aust.*, 24 (1920), Nos. 4, pp. 289-297; 5, pp. 387-396).—A summary of what are considered to be reliable data for the guidance of present-day practice in the use of fertilizers and manures in South Australia is presented.

It is stated that probably more than 99 per cent of the artificial manures used by South Australian farmers is superphosphate. The data summarized, especially that from the Roseworthy Agricultural College, are taken to indicate that with present market conditions an increase in the mean applications of superphosphate is justified. This is especially true with wheat, and it is recommended that mean applications be nearer 200 lbs. than 100 lbs. per acre. A warning is given, however, against the use of superphosphate on acid soils, where the use of basic slag or rock phosphate instead is advocated.

It is concluded that the soils of the region apparently have no present pressing need for available nitrogenous fertilizers, although it is shown that under certain conditions sodium nitrate applied with heavy phosphatic dressings may prove profitable. At the present prices of potassic manures it is said to be cheaper to resort to treatment measures which will make soil potash available to crops.

Further data are summarized which show that farmyard manure is not very profitable when applied directly to wheat, and a preference is expressed for using it as an indirect manure.

On the preparation of cyanamid of calcium, N. KAMEYAMA (*Jour. Col. Engin., Tokyo Imp. Univ.*, 10 (1920), No. 8, pp. 173-207).—Studies are reported in which it was found that when calcium cyanamid is prepared by igniting urea with lime, calcium cyanate is formed as an intermediate product at temperatures below 300° C. Transformation into cyanamid takes place slowly at from 340 to 360° and rapidly at or above 450°. The heating should be of short duration to prevent oxidation of the cyanamid, from 5 to 7 minutes at 800° being sufficient.

The initial proportions of urea and lime were found to govern the percentage of cyanamid in the mixed product. Mixtures in proportions of 1:2, 1:1½, and 1:1 yielded products containing 16.5, 24, and 34 per cent of calcium cyanamid, respectively, or from 92 to 98 per cent of the theoretical yield. Ignition in a current of nitrogen gave a quantitative yield.

When dicyandiamid was used in place of urea, the cyanamid content of the product was found to be higher and the carbonate content lower, although the actual yield in percentage of the theoretical was less. No calcium cyanate was formed even at temperatures as low as from 300 to 400°. The best results were obtained when equal parts of dicyandiamid and lime were mixed and ignited at from 900 to 1,000° for about 10 minutes, resulting in the decomposition of the calcium carbonate in the product. The product of this process contains from 50 to 53 per cent of calcium cyanamid and less than 3 per cent of calcium carbonate. The cyanamid content may be increased up to about 90 per cent by reheating twice with an excess of dicyandiamid, and further, up to 99 per cent, by heating twice or more in a current of nitrogen.

Studies on calcium cyanamid, N. KAMEYAMA (*Jour. Col. Engin., Tokyo Imp. Univ.*, 10 (1920), No. 9, pp. 209-247, pls. 5, figs. 2).—In a second report of this series studies of the action of oxygen, carbon dioxid, and carbon monoxid on calcium cyanamid are described.

It was found that oxygen reacts rapidly at from 420 to 450° C. with calcium cyanamid, prepared from dicyandiamid and lime, forming calcium carbonate and nitrogen, but causing no separation of carbon. At a temperature of from 840 to 900° the reaction products were calcium oxid, carbon dioxid, and nitrogen.

With carbon dioxid, decomposition occurred between 700 and 1,070° without separation of carbon, the products being carbon monoxid, nitrogen, and calcium oxid or carbonate, according to the temperature. At 1,110° or higher the reaction was very rapid and carbon was liberated.

It was further found that carbon monoxid does not act upon calcium cyanamid at temperatures up to 1,000° in the absence of any catalyst, but that if carbon dioxid is produced from the carbon monoxid the cyanamid may be indirectly oxidized by it. At temperatures of 1,140° or above, carbon monoxid was found to decompose calcium cyanamid in the absence of any catalysts, calcium oxid, carbon, and nitrogen being formed.

Heat of combustion and heat of formation of calcium cyanamid, N. KAMEYAMA (*Jour. Col. Engin., Tokyo Imp. Univ., 10 (1920), No. 10, pp. 249-263*).—In a third report of this series, the results of studies on the heat of combustion and of formation of calcium cyanamid are presented. It was found that the heat of combustion of pure calcium cyanamid is 154,730 calories per gram molecule at constant pressure, and that the heat of formation with crystalline carbon is 91,480 calories, and with amorphous carbon 94,820 calories.

Soil studies, J. B. LINDSEY (*Massachusetts Sta. Rpt. 1920, p. 25a*).—Studies on soils in which ammonium sulphate exerted a toxic effect on plant growth showed that these soils contain at least 175 parts of manganese sulphate per 1,000,000 parts of dry soil. This is considered sufficient to be very poisonous to many kinds of plants. The addition of lime to the soil is said to prevent the injury caused by ammonium sulphate by promoting the formation of calcium sulphate instead of the other salts.

Studies on the acid amid fraction of the nitrogen of peat, I, E. J. MILLER and C. S. ROBINSON (*Soil Sci., 11 (1921), No. 6, pp. 457-467*).—Studies conducted at the Michigan Experiment Station are reported, in which attempts to separate glutaminic acid directly from the hydrolysate of peat failed. The application of Foreman's method resulted in the separation of both glutaminic and aspartic acids and the estimation of pyrrolidone carboxylic acid from this material.

Finely ground raw phosphate, A. F. ELLIS (*New Zeal. Jour. Agr., 22 (1921), No. 6, pp. 335-340*).—American, English, and New Zealand experience on the use of finely ground raw rock phosphate is summarized.

It is stated that in New Zealand finely ground raw phosphate gives good results, especially as a top-dressing on soils with an acid tendency or fairly rich in humus and where there is sufficient rainfall. It is concluded that, where the rainfall is sufficient, it may also be considered a satisfactory substitute for basic slag.

For cropping purposes a mixture of one part superphosphate and two parts ground raw phosphate, or a mixture of equal amounts of these materials, has been found to be as effective as superphosphate alone, while the beneficial effects extend over a longer period. The beneficial results of ground raw phosphate depend very largely upon the fineness of grinding, which should be such that at least 80 per cent will pass through a No. 100 sieve.

The relation of organic matter and the feeding power of plants to the utilization of rock phosphate, F. C. BAUER (*Soil Sci., 12 (1921), No. 1, pp. 21-41*).—Studies conducted at the Wisconsin Experiment Station are reported, in which experiments were made as follows: (1) Rock phosphate was mixed with several forms of organic matter in sand and soil with no provision for the

removal of phosphorus as it became soluble, (2) in similar mixtures provision was made by leaching for the removal of phosphorus as it became soluble, (3) in other similar mixtures provision was made by upward-moving capillary water for the removal of phosphorus as it became soluble, (4) the solvent effect of organic matter extracts, with and without carbon dioxide, on rock phosphate was tested, and (5) pot-culture experiments were made, and the feeding powers of plants in relation to the utilization of rock phosphate and feldspar investigated.

Experiments 1, 2, 3, and 4 failed to show a solvent effect of the decaying organic matter on rock phosphate, and in accordance with the findings of several other investigators the results in all cases showed a decreased amount of soluble phosphorus from that present at the beginning. In some cases mixtures of organic matter and rock phosphate applied to pot cultures produced increases in the growth of corn over the combined separate increases of organic matter and rock phosphate. The phosphorus of the organic matter became available readily to corn. The decaying organic matter either had a solvent action on the rock phosphate, or else the phosphorus supplied by the organic matter gave the corn seedlings a better start so that they were enabled to exert a stronger feeding power toward the rock phosphate.

A study of the growth of 15 different plants on rock phosphate in sand cultures showed a wide variation in the amount of dry matter produced. There was no definite relation of the amount of plant growth to the extent of the root systems, the phosphorus content, or the acidity of the plant juices. The applications of rock phosphate were too large to allow a critical examination of the relation between the feeding power and the calcium content. The greater ability of some plants which are high in calcium to feed on rock phosphate than on feldspar is considered to be in accordance with the theory that plants high in calcium are good feeders on rock phosphate. Sweet clover was found to possess remarkable feeding powers toward rock phosphate and feldspar and is considered to be well suited to rotations for the utilization of these. The possibility of growing crops of high feeding power to supply organic matter and available phosphorus in rotations with crops of low feeding power is thought to be a question of considerable practical importance in the utilization of rock phosphate.

The effect of fluorspar additions on the phosphates in basic slag, F. BAINBRIDGE (*Iron and Steel Inst. [London], Carnegie Scholarship Mem., 10 (1920), pp. 1-40, pls. 4, figs. 12*).—Studies on the manurial value of basic slag containing fluorspar are reported.

These showed that when such a slag is used for manurial purposes and is applied just before the seed is sown in the spring the crop is not as good as when a more soluble slag is applied at the same time and in the same proportion with regard to total phosphoric acid. When a slag containing large amounts of fluorspar is applied in the late autumn, the proportionate yield, compared with the yield of a soluble slag, is better than when the same slags are applied just before the seed is sown in the spring. Notwithstanding its low solubility, however, it is concluded that basic slag made with the addition of fluorspar has considerable fertilizing value. When barley was grown in soil treated with a citric-soluble phosphoric slag, the phosphoric acid content of the grain and straw produced was much greater than when a phosphoric slag made with large additions of fluorspar was applied under similar conditions.

Studies of the nature and solubility of the phosphates contained in basic open-hearth slag made with additions of fluorspar showed that when a sufficient quantity of calcium fluoride is added to a molten basic slag the whole of the phosphate is converted into apatite, which has a very low citric acid solubility. Owing to the very high temperature required, it is considered extremely prob-

able that pure synthetic tetrabasic calcium phosphate has never before been prepared except in the open-hearth furnace, and then only in square tabular prisms, and that this material has only a moderate citric acid solubility. The opinion is also expressed that the hexagonal needle crystals described by Hilgenstock in his attempt to prepare tetrabasic calcium phosphate by aiding calcium fluorid were probably apatite crystals. The silicophosphate of lime of the formula $3\text{CaO.P}_2\text{O}_5:2\text{CaO.SiO}_2$ is said to be extremely soluble in citric acid solution, and it is concluded that this or a similar silicophosphate such as steadite is the form taken by phosphoric acid in extremely soluble basic slags. It is further concluded that free lime does not exist to any extent in the normally produced basic slag when the phosphoric acid content is approximately 14 per cent.

A set of experiments are appended on the effect of the addition of lime on the citric acid solubility of a basic slag. These showed that on remelting the original slag the solubility of the phosphate in citric-acid solution was considerably increased. The addition of lime above that already present in the original slag did not appreciably affect the solubility except as far as the dilution of the phosphate is concerned. The added lime apparently combined to form a compound nearly insoluble in citric acid and did not exist in the free state. The silica was almost completely soluble, and the iron compounds were only slightly soluble in 2 per cent citric-acid solution. It is concluded that the insoluble lime was combined with iron oxid.

A bibliography is appended.

The utilization of basic slag, E. J. RUSSELL (*Faraday Soc. Trans.*, 16 (1921), No. 2, pp. 263-268; also in *Chem. News*, 122 (1921), No. 3175, pp. 73-75).—The author discusses the fertilizing properties of Bessemer and low and high grade open-hearth basic slags and regards phosphorus as the essential fertilizing constituent therein. He admits, on the basis of experiments of others, that a silico phosphate may have a special fertilizer value, and that the basic nature of the slag is also important.

Potash from kelp.—IV, Continuous countercurrent lixiviation of charred kelp, J. W. TURENTINE and P. S. SHOAF (*Jour. Indus. and Engin. Chem.*, 13 (1921), No. 7, pp. 605-609, figs. 2).—In a fourth contribution to the subject by the Bureau of Soils of the U. S. Department of Agriculture (E. S. R., 44, p. 23), a continuous, automatic, countercurrent, multiple stage lixiviator is described, based on the employment of any one of the standard continuous rotary filters. The solids to be extracted are alternately extracted and filtered. They flow through the apparatus countercurrent-wise against a stream of the leaching agent. The apparatus, developed for the extraction of potash salts and other values from kelp charcoal, is applicable to the washing or extraction of any materials that can be filtered on the standard vacuum filters.

Data on operation are given showing an average extraction efficiency of 97.9 per cent at normal capacity. The gross cost for treating 1 ton of charred kelp is estimated as \$3.638.

The fineness of lime and limestone application as related to crop production, W. FREAR (*Jour. Amer. Soc. Agron.*, 13 (1921), No. 4, pp. 171-184, fig. 1).—In a contribution from the Pennsylvania Experiment Station, the author summarizes the results of pot and field experiments from different sources, conducted to determine the proper fineness of limestone.

It is concluded that the matter is of enough economic importance to justify much more carefully checked field experiments for a number of rotations with limestone of carefully ascertained fineness and composition, and with a thorough cost method applied to the results. It is further concluded that until the results

of such work are available, without carrying the detail to refinement, the present value of fine material should be emphasized, and that all suggestions of considerable and early returns from material coarser than 40 mesh should be avoided.

The effects of liming on the availability of soil potassium, phosphorus, and sulphur. J. K. PLUMMER (*Jour. Amer. Soc. Agron.*, 13 (1921), No. 4, pp. 162-171).—In a contribution from the North Carolina Experiment Station a summary is given of the more important studies on the effects of liming on the availability of soil potassium, phosphate, and sulphur.

It is stated that the more recent research, embodying laboratory extractions with weak solvents, pot studies using a variety of plants as indicators of the concentration of the soil solution in potassium and the analysis of their ash, lysimeter experiments from which the outgo of potassium has been measured, and field tests, has failed to show that basic compounds of calcium and magnesium increase by chemical action to any practical extent the availability of the soil store of native potassium.

The evidence is considered not yet sufficient to indicate that the addition of lime will reduce the necessity of applying soluble phosphates to the soil. As measured by yields, phosphates of iron and aluminum seem to be as available as calcium phosphates. Additions of lime before or after applications of soluble phosphates have greatly increased the efficiency of the phosphatic fertilizers. When insoluble calcium phosphate has been applied, it seems that applications of lime have reduced the effectiveness of the phosphate in a majority of cases.

The scant data of lysimeter experiments only, which deal with the question of sulphate availability or conservation, seem to show that liming with small amounts of calcium oxid and both small and large amounts of magnesium oxid, magnesium carbonate, limestone, dolomite, and magnesite increases the solubility of native soil sulphate. Heavy applications of calcium oxid for a few years at least apparently reduce this loss of sulphur from the soil.

Registered brands of fertilizers and lime. J. W. KELLOGG (*Penn. Dept. Agr. Bul.* 355 (1921), pp. 47).—This bulletin contains a list of brands of fertilizers, fertilizer materials, and lime registered for sale in Pennsylvania during the year 1921, together with a list of manufacturers, producers, and importers.

AGRICULTURAL BOTANY.

[Carnegie Institution of Washington, report of] department of botanical research, D. T. MACDOUGAL ET AL. (*Carnegie Inst. Wash. Yearbook* 19 (1920), pp. 49-81).—Attention has been directed during the year to the study of fundamental problems in growth and hydration, carbohydrate metabolism and nutrition, soil-aeration effects, and to the special problems of physiology and ecology presented by the vegetation of arid regions. Detailed accounts of some results obtained are briefly noted below.

Course of growth in trees as measured by the dendrograph. D. T. MacDougal.—Study and use of the dendrograph, designed in 1918 for making continuous records of variations in tree trunks, have led to the improvement of this instrument to its approximate final form.

A period of several weeks may intervene between the awakened activity of the tops of the branches and increase in trunk diameter, especially in pines. Resting trees may be awakened by a renewed supply of ground water. Measurement of the variations in woody cylinders offers opportunities for estimation of changes of surface tension in wood cells containing water and gas bubbles and the part which this may play in the ascent of sap and other purely physical phenomena.

Measurement of a season's growth of trees by the newly designed dendrometer, D. T. MacDougal.—An instrument designated as a dendrometer, designed to register the total amount of growth of trees, was put into operation during 1920.

Growth and accumulation of reserve material as measured in the potato, D. T. MacDougal.—Tubers, like all other organs the growth of which has been studied, show a daily variation controlled by water supply and water loss. Actual enlargement is checked or canceled during the midday period.

Components and colloidal behavior of plant protoplasm, D. T. MacDougal and H. A. Spoehr.—Recent researches have led to the consideration of the proportions of carbohydrate and albuminous matter in a colloid of the highest hydration capacity; the substances or ions of biological significance which would raise the hydration capacity of these phytocolloids to the highest limit; measurement of the relative effects of some metallic bases upon a carbohydrate colloid; and determination of the amplitude and continuance of alternating or repeated effects of renewed or replaced solutions. The results of extensive auxographic measurements are indicated.

Effect of a diminished oxygen supply in the soil on the rate of the growth of roots, W. A. Cannon.—Studies on the reaction of roots to a soil atmosphere poor in oxygen or to one having an excess of carbon dioxid have been continued and extended to include species for the most part not previously used. Among these are such cultivated plants as alfalfa, barley, onions, peas, and rice. The results as summarized confirm and extend those previously reached to the effect that different species may react differently and characteristically to a soil atmosphere consisting of nitrogen only, or of nitrogen and oxygen in known subnormal amounts. Different species may hold unlike relations to a soil atmosphere rich in carbon dioxid, whether or not the normal amount of oxygen be present. It appears, therefore, that root growth rate may be directly affected by carbon dioxid excess or oxygen deficiency, both of which are important in soil aeration.

Anaerobic experiments with helium, W. A. Cannon and E. E. Free.—Experimentation has confirmed the observation that nitrogen and helium do not behave exactly alike when used in soil aeration experiments. No difference is observed between the two gases when the conditions are entirely anaerobic, or when the gas mixtures contain an ample percentage of oxygen. The differences appear in using nitrogen and helium, each containing small percentages of oxygen. It is believed that the difference observed is due to the fact that oxygen diffuses through helium more rapidly than through nitrogen. The hypothesis is suggested that the diffusional relations are effective in the film of adsorbed gas which doubtless blankets the surface of the living material.

Root adaptation to deficient soil aeration, W. A. Cannon and E. E. Free.—When plants of *Zea mays* are grown in aerated soil and the soil oxygen then removed, the roots do not die, though both the roots and shoot cease growth for a period of several days. Growth is then resumed and continues at a lesser rate than under complete aeration.

Rate of respiration of leaves in relation to amino-acid and carbohydrate content, H. A. Spoehr and J. M. McGee.—It is found that in general the carbon dioxid emission rate of leaves is influenced not only by the amount of available carbohydrate, but also by other complementary factors. Amino acid exercised a stimulating effect on the respiratory activity of leaves. High sugar and amino-acid content resulted in a very high respiration rate. However, it is apparently not a simple mathematical ratio between carbohydrate and amino-acid content which governs the rate of respiration.

Interrelation of photosynthesis and respiration, H. A. Spoehr.—Extension and elaboration of work previously reported (E. S. R., 45, p. 334) has sub-

stantiated the principles already indicated. The respiratory activity of a chlorophyllous leaf affects fundamentally the rate of photosynthetic carbon dioxid fixation. This relation of respiration and photosynthesis is, moreover, one of very delicate adjustment.

Reduction and dehydration of pentose sugars, H. A. Spoehr and J. W. E. Glattfeld.—Physiological-chemical investigation of plant metabolism has been directed mainly toward a study of catabolic processes in the living organism, these processes being, in general, in the nature of hydrolysis and oxidation. All evidence points to the conclusion that sugars are the first products which accumulate in the process of photosynthesis, and they thus form the starting point for the synthesis of substances found in plants.

Salt requirements of seed plants, B. M. Duggar.—Experimentation indicates that the best salt solution for any particular plant may be regarded as analogous to an "optimum" temperature, being affected by many variable factors. The results of a study of Pacific Bluestem wheat are briefly indicated and discussed.

Biological and physical factors affecting plants in new habitats, D. T. MacDougal.—The plan of these investigations included the establishment of small experimental areas in four places in which the environmental complexes were widely different, the introduction of species from outside localities, and the exchange of species from outside localities to experimental plats. The experiments indicate that the habitat in which a plant may be found or in which it may have originated may not furnish the most favorable environmental complex, as amply illustrated by the behavior of species that have become weeds.

Hydrogen-ion concentration of Carmel Valley soils, B. M. Duggar.—The outstanding feature of interest in this work is the relatively narrow range of reaction, pH 6.2 to pH 7.4. The more alkaline types were those of the lower flood plain of the river or river bottom and certain adobe soils taken at a depth of a foot or more below the surface.

Causes of the seasonal changes in the transpiration of Encelia farinosa, E. B. Shreve.—Investigation of the desert perennial *E. farinosa*, which possesses some means of reducing its ratio of transpiration to evaporation during a period of increasing aridity, confirms the presence of a brown liquid in the stems and leaves during the drought, which seems to be absent during cooler months and to be more abundant during some years than in others. The influence of this sap, and of the pressed juice of the leaves, on the imbibition of agar and of gelatin has been investigated. Changes in acid content do not appear to be influential in this connection.

The vegetation of a desert valley, F. Shreve.—Work begun in 1918 on the relation of environmental conditions to the distribution of vegetation in the poorly drained Avra Valley has been extended, the object being to determine to what extent and in what manner observed differences result from the character of the soil or from other conditions.

Ecology of the Santa Lucia Mountains, F. Shreve.—Further exploration of the Santa Lucia Range has strengthened the observation that no constant differences of vegetation exist between seaward and landward slopes. A preliminary instrumental observation carried out in the summer of 1920 on physical conditions accompanying certain vegetational phenomena has furnished data regarding temperature, evaporation, and soil moisture, and the influence of altitude and distance from the sea on these conditions.

The data thus far secured appear to offer ground for the explanation of the distinctive vegetational features of the coastal belt and of the lack of greater altitudinal differences of vegetation.

Ecology of the strand vegetation of the Pacific coast of North America, W. S. Cooper.—Continuation of habitat and permanent quadrat studies previously begun leads to the conclusion that the mountains cause a striking difference observed in precipitation, and that precipitation is not a ruling factor in the production of luxuriant pine forest on the Monterey Peninsula.

Some structural features of the chlorophyll-bearing organs of perennials of South Australia, W. A. Cannon.—A study of adjustments to water and light in Australian perennials named is briefly indicated.

The fact that organs of varied morphological relations exhibit a strong parallelism in the nature of the structure suggests on the one hand the potent influence of the impinging environment, and on the other a parallelism in capacities for adjustment on the part of the reactive organs themselves. It appears, therefore, that the formation of heavy cell-walls is closely associated with aridity, which is the most striking feature of the local environment. This conclusion finds support in the fact that under arid conditions polysaccharids may be converted into anhydrides, or cell-wall material.

[**Heredity studies**], C. B. DAVENPORT (*Carnegie Inst. Wash. Yearbook 19 (1920)*, pp. 107-110).—Attention is called to the discovery that mutation of two types may occur, one being due to irregularities of assortment of chromosomes and the other to changes in the chromosomes themselves. These are designated as interchromosomal and intrachromosomal mutations. A second discovery of considerable importance is that some of the irregular breeding behavior of *Datura* is due to irregularities of chromosome division, resulting in extra chromosomes in some gametes and a deficiency in others.

Inheritance of germinal peculiarities [in] flowering plants (*Carnegie Inst. Wash. Yearbook 19 (1920)*, pp. 130-132).—Breeding work by A. F. Blakeslee relating to *Portulaca* and *Datura* is briefly indicated. The work with *Datura* has been brought to a close on the graft-infectious disease "quercina," which causes profound morphological changes in the plants affected. It is suggested that the non-Mendelian behavior in garden peas may be due to a similar type of disease.

The vascular anatomy of variant bean seedlings (*Carnegie Inst. Wash. Yearbook 19 (1920)*, p. 139).—Results of cooperative studies by J. A. Harris, E. W. Sinnott, J. Y. Pennypacker, and G. B. Durham, as briefly indicated, show that external differentiation, such as that which characterizes dimerous and trimerous seedlings of *Phaseolus vulgaris*, is accompanied by profound differences in internal structure. They show further that anatomical characters generally regarded as relatively stable may be highly variable, even in series which are genetically highly homogeneous.

Adaptation and mutation as a result of fire, F. E. CLEMENTS (*Carnegie Inst. Wash. Yearbook 19 (1920)*, pp. 348, 349).—As a consequence of fire and the result of exposure to sunlight, modification of vegetation occurred, the most striking consequence of the fire being the apparent origin by mutation of a new form-genus of grasses, which has been studied.

Plant production quadrats, J. E. WEAVER (*Carnegie Inst. Wash. Yearbook 19 (1920)*, pp. 357-358).—A study of the effect of climate upon the production of natural vegetation has been made at several stations through the grassland formation. The results thus far indicate a rather direct correlation between available water content and plant production.

Climatic cycles [and tree growth], F. E. CLEMENTS and A. E. DOUGLASS (*Carnegie Inst. Wash. Yearbook 19 (1920)*, pp. 358, 359).—In further studies of the correlation between climatic cycles and tree growth, a standard curve has been constructed for *Sequoia*, reaching back 3,300 years and serving as a standard to which all *Sequoia* curves may be referred; also as a basis for

checking and cross-identifying the results from trees of adjacent regions. An extensive study has been made of the relation of drought periods to climatic cycles throughout the West. The results showed that every State has had from two to four years of critical drought at the most intense sun-spot maxima, which fact is also fully disclosed in the totals for the entire region.

Indicator plants, F. E. CLEMENTS (*Carnegie Inst. Wash. Yearbook 19 (1920)*, pp. 363, 364).—The basic discovery has been made that all dominants and sub-dominants in a group are indicators of competition with each other to varying degrees. Under optimum conditions, lacking competition, dominant grasses of true and mixed prairie grow two or three times greater in height than the usual height in the community.

Changes in vegetation, F. E. and E. S. CLEMENTS (*Carnegie Inst. Wash. Yearbook 19 (1920)*, pp. 351-353).—The universal importance of grazing as a primary factor in the structure of grassland has now been confirmed beyond any question. The evidence, which is lengthy, is to be treated in a special paper.

The disappearance of the buffalo grass and the incoming of the bluestems is said to be purely an effect of grazing.

Where grassland touches sagebrush or shrub, grazing alone favors the shrub. Where fire enters regularly this advantage is more than offset and the grasses encroach upon the shrub.

Natural parks, F. E. and E. S. CLEMENTS (*Carnegie Inst. Wash. Yearbook 19 (1920)*, pp. 353, 354).—A comprehensive survey was made of the natural parks of Colorado, with special reference to their causes and origin. It is thought that most natural parks are due to fire, a secondary succession developing on the burned area and persisting for a long time in the subclimax or grass stage. A very large number of parks also arise as a consequence of primary succession in lakes and ponds.

Crop development and production studies, F. E. CLEMENTS and J. E. WEAVER (*Carnegie Inst. Wash. Yearbook 19 (1920)*, p. 357).—The development and production of certain crop plants have been studied at the stations at Lincoln, Nebr.; Phillipsburg, Kans.; and Burlington, Colo., dealing with White Kherson oats, Marquis spring wheat, barley, alfalfa, white sweet clover, and sunflowers. The correlation of crop production with native vegetation was found to be least at Burlington and usually greatest at Lincoln.

Titanium, barium, strontium, and lithium in certain plants, W. P. HEADEN (*Colorado Sta. Bul. 267 (1921)*, pp. 3-20).—As a contribution to the subject of the selective power of plants, the author gives the results of examinations of the ash of a number of species for titanium, barium, strontium, and lithium, all of which are said to be present to some degree in Colorado soils and water. Plants of different kinds were grown, often side by side, and analyses made of their ash. Others were secured from various sources and analyzed.

Alfalfa was found relatively rich in barium and strontium and very poor in lithium. Sweet clover appeared to excel alfalfa in its ability to take up barium. Flowering tobacco (*Nicotiana affinis*) showed a relatively high content of barium, strontium, and lithium, while of 9 samples of field tobacco (*N. tabacum*) analyzed, 8 contained barium, 1 a trace of strontium, and all contained lithium. The largest amount of barium in tobacco was found in the stalks of a sample grown at Nacogdoches, Tex. Two samples of loco weed were analyzed, and a species of *Astragalus*, supposed to be a dangerous plant, was not found as rich in barium and strontium as some other plants and was very poor in lithium. A sample of *Aragallus*, obtained in the mountains, is said to have been of little interest except that it showed very small quantities of the substances investigated. Alfalfa grown at the same place differed

from samples grown on the plains only in the amount of barium and strontium present.

Corn leaves were found fairly rich in barium, strontium, and lithium, and unusually so in titanium, but it is thought that the crude ash was contaminated with sand and this may have accounted for the amount of titanium present. A sample of pea vines analyzed was rich in barium and lithium, but poor in strontium. In potato tubers barium was absent, strontium and lithium occurring in traces only, and titanium was found to belong to the ash proper.

Analysis made of leaves and roots of beets showed that lithium and manganese occurred in the tops and roots, although previous investigators have reported the absence of lithium from beets and that manganese is of rare occurrence in that crop. Neither rubidium nor caesium were found.

Experimental studies on mitochondria in plant cells, N. H. COWDRY (*Biol. Bul. Mar. Biol. Lab. Woods Hole*, 39 (1920), No. 3, pp. 188-206, pls. 3).—In experiments with rootlets of sprouting peas under a wide range of conditions, observations have been made of the cortical cells between the elongating part and the root cap. It appears that mitochondria are changed to an abnormal degree only under severe conditions which either kill the cell or render its recovery very improbable.

Root development and absorption, J. E. WEAVER (*Carnegie Inst. Wash. Yearbook 19* (1920), p. 358).—In connection with the root development of crop plants, a series of experiments on barley was made to determine the degree of absorption at different levels throughout a period of growth. The method lends itself readily also to the study of root development in soil layers of different texture, different water content or air content, and to experimentation in soil fertility.

Photosynthetic efficiency, F. E. CLEMENTS and F. LONG (*Carnegie Inst. Wash. Yearbook 19* (1920), pp. 344, 345).—The results so far obtained in measuring photosynthetic activity show definite correspondence with the light intensity, which is marked in certain cases. Some evidence exists that species growing normally in the shade possess higher photosynthetic efficiency than the shade ecads of sun species. Recording photometers have been used for the first time to determine the complete curve of light intensity for the day.

Inventories of seeds and plants imported by the Office of Foreign Seed and Plant Introduction (*U. S. Dept. Agr., Bur. Plant Indus. Inventories Nos. 48* (1921), pp. 56, pls. 5; 49 (1921), pp. 117, pls. 8).—These numbers give, respectively, descriptive economic notes of nearly 400 varieties of seeds and plants introduced from July 1 to September 30, 1916, and nearly 600 from October 1 to December 31, 1916.

FIELD CROPS.

Crop production, G. KRAFFT, rev. by C. FREUWIRTH (*Die Ackerbaulehre. Berlin: Paul Parey, 1921, 13.-14. ed., rev., pp. VIII+372, pls. 5, figs. 375*).—This volume, the first of a series already noted (*E. S. R.*, 28, p. 826), treats of cultural and field practices, implements, and other factors involved in general crop production. The successive chapters deal with plant anatomy and physiology, the soil, environmental conditions, interrelations of plants, soil amelioration and improvement, preparation of the seed bed, fertilizing, seeding, cultivation, harvest and storage, and plant breeding.

The value of research on grain crops, C. R. BALL (*Missouri State Bd. Agr. Mo. Bul.*, 19 (1921), No. 3, pp. 23).—A general discussion of the work of the Office of Cereal Investigations, U. S. Department of Agriculture, and the State

experiment stations in crop improvement, classification and description of cereal varieties, breeding for cold and rust resistance, and controlling diseases of cereals.

Cereal investigations in Bulgaria, I. A. T. DJEBAROFF (*Spisanie Zemedel'skitie Ispitatelni Instituti Bŭlgariia* (Rev. Inst. Recherches Agron. Bulgarie), 1 (1920), No. 5-6, pp. 404-443).—Analyses of numerous samples of grain from the districts of Trin and Zaribrod in western Bulgaria showed a fairly high weight per hectoliter in oats, barley, wheat, and rye. The weight per 100 kernels was satisfactory except in rye. The percentage of purity was for oats 91.1, rye 83.6, barley 81.7, and wheat 52.6.

Some Florida grasses, J. B. THOMPSON (*Fla. Univ. Ext. Bul.* 28 (1921), pp. 44, figs. 15).—Under the topics of hay grasses, hay from wild grasses, crops for soiling and silage, pasture grasses, and native range grasses, this bulletin describes the plants and indicates cultural practices for important grasses grown and tested in Florida.

Grades of hay and straw (*Natl. Hay Press*, 5 (1921), No. 1, pp. 15-17).—The grades noted (E. S. R., 44, p. 229), revised August 24, 1921, are outlined.

Forage crops, J. B. LINDSEY (*Massachusetts Sta. Rpt.* 1920, pp. 24a, 25a).—Barnyard millet and early amber sorghum proved more desirable than Sudan grass, which was planted at the station for several years without success. Alfalfa, red clover, and sweet clover, seeded with peas and oats, developed well and each produced very satisfactory stands after removal of the peas and oats.

A discovery: Andropogon purpureo-sericeus and its importance in the improvement of grazing areas in the Bombay Deccan, L. B. KULKARNI (*Agr. Jour. India*, 16 (1921), No. 4, pp. 388-395, pl. 1).—*A. purpureo-sericeus*, an indigenous fodder grass with quick, tall growth, demonstrated its value for poor land, yielding up to 5,000 lbs. of green grass per acre. It suppressed *A. [Heteropogon] contortus*, which is dominant on vast areas of poor land of the Deccan, and proved drought resistant and useful as a nurse crop for perennial grasses.

Fertilizers for alfalfa in eastern Kansas, L. E. CALL, R. I. THROCKMORTON, C. C. CUNNINGHAM, and B. S. WILSON (*Kansas Sta. Bul.* 226 (1921), pp. 30, figs. 3).—Although Kansas is outstanding in alfalfa production, the acreage declined from 1,359,498 acres in 1915 to 1,243,227 in 1920. When alfalfa was introduced into the State the soils were new and a stand was easily secured with proper inoculation, while at present greater care is needed in seed bed preparation, and on many soils old well-established fields must be fertilized to prevent loss of vigor and crowding out by weeds and grass. The best alfalfa soils are well supplied with potassium and calcium, but less calcium is present in eastern Kansas soils and the lack of the element in southeastern Kansas often precludes the successful culture of the crop. The soils of the State are lower in phosphorus than in any other plant food.

Experiments in fertilizing and manuring alfalfa were conducted at the station and on farms in Nemaha, Allen, Labette, Chase, and Butler Counties. Where acid phosphate and manure were applied alone and in combination with chemicals and lime on alfalfa grown continuously and in rotations at the station from 1911 to 1920, the results are said to have shown conclusively the profitable use of acid phosphate, manure, and lime on alfalfa, and the value of nitrogen at seeding time. The use of potash is held to be unprofitable at current prices. Rock phosphate was not so profitable as acid phosphate, and did not greatly increase alfalfa yields except on bottom land in Butler County. Barnyard manure applied to alfalfa gave very profitable returns, but when limited in amount its use is advised on cultivated crops and the alfalfa fertilized with acid phosphate.

On established stands of alfalfa the application of about 300 lbs. of acid phosphate per acre every second year in early spring is suggested. Prior to seeding new stands, the use of about 200 lbs. per acre of a 2:10:0 mixture is indicated, except when the field has received barnyard manure recently.

Factors in alfalfa seed production. H. H. BIGGAR (*Dakota Farmer*, 41 (1921), No. 17, pp. 757, 758, fig. 1).—A digest of observations at experiment stations in South Dakota, North Dakota, Colorado, New Mexico, Utah, Wyoming, and Idaho on the factors involved in the production of alfalfa seed.

Alfalfa culturc. R. GARCIA OSES (*Estac. Agr. Expt. Rio Verde, San Luis Potosí, Bol.* 6 (1921), pp. 68, pls. 6).—A general discussion of the principal factors involved in the successful production of alfalfa in Mexico, with notes on diseases and insect pests.

Studies of inheritance in cotton.—I, The inheritance of corolla color. S. C. HARLAND (*West Indian Bul.*, 18 (1920), No. 1-2, pp. 13-19).—West Indian native cottons apparently constitute a group of elementary species, the origin of which may be ascribed to distant natural crossing between more or less widely separated types. The segregates from these crosses have passed through many generations with no opportunity for further crossing, and have thus gradually become homozygous. In studies of crosses between Upland and Sea Island and various types of native cotton six different shades of corolla color, ranging from white to very deep yellow, were used.

The F_1 of a cross between any two color types was intermediate. The F_2 results of the cross pale yellow by white are held to indicate that these two colors are possibly allelomorphous. The F_2 progeny of the cross very deep yellow by white evidenced that two pairs of factors are involved. In the cross medium yellow by white, in which a considerable number of F_3 families were grown, the results suggest that probably medium yellow and white constituted an allelomorphous pair of characters. No evidence of correlation between petal color and anther color was found.

Pollination of Pima cotton in relation to the yield of seed and fiber. T. H. KEARNEY (*Jour. Heredity*, 12 (1921), No. 3, pp. 99-101, pl. 1).—Naturally pollinated flowers yielded a much larger number of seeds at Sacaton, Ariz., where bees and wasps were abundant in cotton fields, than at Phoenix, Ariz., where such insects were much less numerous. Hand-pollinated flowers produced practically equal numbers of seeds in both localities. The lint indices (E. S. R., 39, p. 135) of 100-boll samples of seed cotton from 12 different fields in the Salt River Valley evidenced no tendency to a greater abundance of fiber on the seeds in bolls containing few seeds than in bolls with many seeds. On the other hand, the weight of fiber per boll was very closely correlated with the abundance of fiber on the individual seeds (lint index) and was also correlated, although less closely, with the number of seeds in the boll. With no variation in the abundance of fiber per seed in different bolls, the quantity yielded by each boll would be directly proportional to the number of seeds it contains. Since thorough pollination, which results in an increased number of seeds per boll, also increases the yield of fiber, the keeping of honeybees in the vicinity of cotton fields is suggested as a means of enhancing pollination.

A wild cotton. C. T. WHITE (*Queensland Agr. Jour.*, 15 (1921), No. 5, pp. 216-218, fig. 1).—The author describes *Bassia lanuginosa* as a new species of "wild cotton" occurring near the confluence of the Mayne and Diamantina Rivers in western Queensland.

Manurial experiments with Sea Island cotton in St. Vincent in 1918-19, with some notes on the control of certain diseases by spraying. S. C. HARLAND (*West Indian Bul.*, 18 (1920), No. 1-2, pp. 20-33, pls. 2).—In manurial

experiments (E. S. R., 40, p. 627) conducted from 1912-1918 inclusive, cotton grown continuously for a number of years responded markedly to both artificial and organic fertilizers. Potash appeared to be the limiting element, the "rust" disease characteristic of potash exhaustion being found on most of the cultivated land of the colony. Since the combination of potash and phosphate proved inferior to potash alone, the use of phosphate is not recommended. Cottonseed meal appeared to best advantage when supplemented by potash and pen manure.

The fertilizer treatment did not affect the time of maturity of cotton, and differences in fertilizer treatment did not cause noticeable variation in the proportion of bolls to flowers. Under the tropical conditions of St. Vincent there is great uniformity in the time at which flowering and bolling begin, reach the maximum, and end. The bulk of the first crop is picked from 21 to 24 weeks after sowing.

Results of spraying experiments indicate that Burgundy mixture is useless for control of angular spot on bolls, but further tests are required to determine the effects on soft rot (*Phytophthora* sp.) disease.

New Egyptian cotton law (*Egypt Min. Agr., Cotton Research Bd., Ann. Rpt., 1* (1920), pp. 100-102; also in *Agr. Jour. India*, 16 (1921), No. 3, pp. 338-340).—The provisions of the law issued by the Egyptian Government to prevent the mixing of different varieties of unginned cotton and cotton seeds are given.

A study of cotton production in China, Y. T. YEH (*China Cotton Jour.*, 1 (1920), Nos. 2, pp. 233-242; 3, pp. 221-236, pl. 1; abs. in *Bot. Abs.*, 8 (1921), No. 1, p. 7).—A survey of cotton culture in nine provinces in eastern China is reported with notes on climate, soils, varieties, cultural methods, diseases, and insect pests. Suggestions are given for the improvement of cotton production in China.

Official rules governing transactions in cotton seed and in its products and other seed and their products (*Ga. Cotton Seed Crushers' Assoc., Proc.*, 16 (1920), pp. 75-119).—The rules as amended and adopted by the Cotton Seed Crushers' Association of Georgia at Savannah, Ga., May 31 and June 1, 1920, govern transactions in cotton seed, cottonseed oil, soap stock, and cake, and cottonseed meal, linters, and hulls; peanut oil and other products; oils of soy beans, coconut, perilla, rape seed, and sesame, and Chinese vegetable tallow.

The pollen of flax and the degenerescence of the varieties cultivated for the fiber, L. BLARINGHEM (*Nature [London]*, 107 (1921), No. 2698, p. 640).—The study of the quality of the pollen of isolated pedigrees, followed during several generations, is recommended for the selection of flax grown for fiber.

Historical note on experiments with jute in Bengal, R. S. FINLOW (*Agr. Jour. India*, 16 (1921), No. 3, pp. 265-279).—A chronological account of investigations with jute (*Corchorus capsularis*, *C. olitorius*), together with results of comparative trials of varieties and selections.

Practical guide to tropical agriculture.—II, Extensive culture: Peanuts, A. FAUCHÈRE (*Guide Pratique d'Agriculture Tropicale. II, Les Grandes Cultures: Introduction, Arachide. Paris: Augustin Challamel, 1921, pp. 95, figs. 10*).—Part 1 of this treatise, dealing with general factors of agricultural production in the French colonies, has been noted (E. S. R., 40, p. 622). The present volume deals with the history, origin, soil and environmental adaptations, cultural and field methods, harvesting practices, preparation for market, utilization, trade, and insect enemies and diseases of the peanut.

The Colorado wild potato, C. L. FITCH (*Potato Mag.*, 3 (1921), No. 12, pp. 12, 26, 28, figs. 4).—The habitat and growth habits of the Colorado wild potato (*Solanum jamesii*) are described, and its possible use in greenhouse studies is indicated.

Report of committee on potato seed improvement and certification of the Potato Association of America, A. G. TOLAAS (*Potato Mag.*, 3 (1921), No. 12, pp. 9-11, 25).—A progress report with a tabulated summary of potato seed certification in the United States and Canada in 1920.

Some germination tests of prickly pear seeds, E. BREAKWELL (*Agr. Gaz. N. S. Wales*, 32 (1921), No. 8, pp. 579, 580).—Germination tests conducted by Miss M. Bates demonstrated that seed of prickly pear possess remarkable vitality, germination occurring during a period of four years. The different preparatory treatments did not facilitate germination, as the untreated seed gave best results.

Rice production, G. RUIZ VALENCIA (*Estac. Agr. Cent. [Mexico]*, Bol. 52 (1921), pp. 26, pls. 2).—A reprint of a bulletin issued in 1910 giving practical discussion of cultural and field methods and milling practices applicable to rice production in Mexico.

A preliminary classification of the wild rices of the Central Provinces and Berar, S. CHANDRA ROY (*Agr. Jour. India*, 16 (1921), No. 4, pp. 365-380).—The varieties of wild rice common to the Central Provinces and Berar are described and classified.

Soy beans, E. J. KINNEY and G. ROBERTS (*Kentucky Sta. Bul.* 232 (1921), pp. 25-58, fig. 1).—Directions are given for growing soy beans in Kentucky based on variety, cultural, and fertilizer tests. Yields of beans in variety tests, and of soy bean hay on soil experiment fields (E. S. R., 44, p. 510) are tabulated.

Soy beans drilled in 28- and 35-in. rows averaged 17.3 and 15.4 bu. per acre, respectively, and varieties drilled solid made 19.1 bu. as compared with 18.4 bu. from 35-in. rows. Drilled solid for hay, soy beans made an average of 2,320 lbs. per acre in contrast with 2,367 lbs. in 28-in. rows. The station recommends seeding from 50 to 60 lbs. of Haberlandt, 30 to 40 lbs. of Lexington, and 20 to 30 lbs. of Peking per acre in 28-in. rows or slightly less in 35-in. rows. When soy beans were planted in corn hills, between corn hills, in alternate rows of beans and corn, and drilled thick in corn rows, average total acre yields of 46.8, 44.6, 37.8, and 36.7 bu., respectively, were obtained, while corn alone made 47.2 bu. and soy beans alone 19.9 bu. Planting soy beans in the hills of corn is the only method advised.

Sugar cane in St. Croix, L. SMITH (*Virgin Islands Sta. Bul.* 2 (1921), pp. 23, pl. 1, figs. 2).—A review of the development of the sugar industry in St. Croix and experimental work carried on by the station.

Many of the experiments in improvement and trials of seedlings and varieties have been noted from other sources (E. S. R., 45, p. 126). Tabulations show the rainfall by months during the years 1852 to 1920, inclusive, chemical and mechanical analyses of St. Croix soils, comparative yields of leading cane varieties, quantities of sugar and rum exported from the island during the periods 1777 to 1807 and 1835 to 1920, inclusive, and molasses exported from 1835 to 1897, inclusive. Cultural and field practices and harvest methods are outlined, and diseases (E. S. R., 32, p. 643) and insect pests (E. S. R., 45, p. 149) are described and control methods indicated.

The data did not indicate a serious decline in soil fertility during the past 100 years, notwithstanding the lack of crop rotation. Since applications of phosphates, potash, and nitrogen did not give increased returns and analyses disclosed a plentiful supply of available phosphates and potash in the soils, the ordinary methods of land preparation and manuring (20 to 30 tons of farmyard manure per acre on plant cane) were apparently adequate.

During the period 1898 to 1920 an average of 9,216 tons of sugar and 66,657 gal. of rum were exported annually from St. Croix and 13,611 acres of cane were under cultivation.

Saving money with frozen cane, A. H. ROSENFELD (*Internatl. Sugar Jour.*, 23 (1921), No. 270, pp. 316-319, fig. 1).—Sugar cane frozen in June, 1918, on the Santa Ana plantation in Tucuman, Argentina, was cut and used as a mulch in alternate 25-acre fields. The frozen cane from two rows of the mulched fields was carefully piled in one middle and the alternate middle left for cultivation, sufficient space being allowed for weeding the rows with spades or hoes. An area of about 5,000 acres was included in the experiment.

The mulched fields produced as much cane per acre with juice of equal purity as the unmulched fields in practically every case. In the unirrigated sections the mulched fields frequently produced better average yields than did those regularly cultivated. The cost per acre for cultivation of the mulched fields was but half that of the unmulched fields. No particular effect upon the chemical analyses of the cane and juices could be noted.

Productive methods for wheat in Missouri, C. A. HELM and L. J. STADLER (*Missouri Sta. Bul.* 188 (1921), pp. 40, figs. 8).—Cultural methods for wheat are outlined, based on variety and cultural tests at the station and on experiment fields in representative sections of the State. The control of diseases and insect pests is discussed, and notes on devices for harvesting in wet weather, on wheat as a nurse crop for clover and grass, and catch crops, are included. An outline map of the State indicates seeding dates on or after which wheat will escape Hessian fly injury.

Soft red winter varieties found best adapted include Poole and Dietz for the northern section, Fulcaster and Michigan Wonder for the central region, and Fulcaster for the southern portion of the State. The culture of hard red winter wheat is not advisable unless it actually outyields soft wheat in the average of a series of representative seasons.

Wheat on soy bean stubble with no soil preparation yielded equally well as that on oats stubble plowed early and thoroughly prepared (*E. S. R.*, 45, p. 224). Disking and harrowing soy bean stubble had little effect on the following wheat crop, but rolling was rather beneficial. Early summer plowing increased the yield of wheat under all conditions tested. The effect of depth of plowing on yield varied with the soil type. Although seeding between 3 and 10 pk. per acre caused little variation in the yield, from 5 to 6 pk. is considered the safest average rate.

Experiments on wheat growing in the Sudan, F. J. MARTIN and R. E. MASSEY (*Wellcome Trop. Research Labs., Chem. Sect. Pub.* 19 (1921), pp. 24, pl. 1).—Variety, milling, and baking trials were conducted with Australian, Indian, Egyptian, and native wheat at the Shambat Experimental Farm near Khartum. Of varieties imported from many regions of the world, only those of the foregoing types appear of promise.

Federation and Firbank, both Australian wheats, and Indian No. 40 showed marked superiority in yield and quality of grain over indigenous varieties, with Federation exhibiting the most vigorous growth. The superior quality and rust immunity of Federation recommend it for the region. The effect of the Sudan climate in shortening the growth period was most noticeable in the Australian varieties. The protein content of the flours ranged from 9.8 to 10.9 per cent and the moisture content from 10.8 to 11.8 per cent. The diastatic capacity was low in each case. Although the flour from the better varieties was stronger than from commercial English or Indian varieties it did not equal that from American or Russian wheat.

Earliness in wheat and its inheritance, W. P. THOMPSON (*Sci. Agr.*, 1 (1921), No. 5, pp. 193-199).—Supplementing previous work (E. S. R., 44, p. 637) on the inheritance of the length of the period from planting to ripening in wheat, which covered the F_1 , F_2 , and F_3 generations of several crosses, data are presented on later generations of these and other crosses.

F_3 families were found in all possible positions between the parental extremes and coinciding with the extremes. While possibly due in part to environmental influences, the resemblance of the F_1 families to their F_3 parents in regard to position makes this appear to be the result of genetic constitution. The very variable F_3 families gave rise to some very variable F_4 families and to some slightly variable ones, while the slightly variable F_3 families produced F_4 of the same kind. The F_4 results indicated that in several F_3 families the earliness of the early parent was evidently recovered in the homozygous condition. Many F_3 families raised in 1920 were evidently also quite as early as the early parent and homozygous as well.

Chlorophyll as a factor in wheat varietal investigations, K. WESTERMEIER (*Ztschr. Pflanzenzücht.*, 8 (1921), No. 1, pp. 14-25).—The relations of leaf color to extent and vigor of plant growth and to yield and composition of grain were studied in 29 different varieties of wheat.

Among plants of the *vulgare* race with a yellow green color, the darker leaf color accompanied the slower rates of growth. In the case of seedlings the darker leaved individuals grew faster, retaining the rate until growth ceased. Seedlings of the darker varieties appeared to be later than those of the lighter strains. Similarly, the darker varieties bloomed and ripened later and had a longer vegetative period. *Vulgare* plants of pure green color behaved like those of yellow green except that the seedlings of the lighter varieties grew faster and the plants developed more rapidly than the yellow green group, indicating the different effects of color tones. The pure green appeared to utilize sun energy to better advantage.

Color and growth in the *compactum* forms behaved as in *vulgare*, indicating the close relation between the two forms. In the *turgidum* forms the darker colored groups grew faster at first, but were finally overtaken in the flowering stage by the lighter colors, which had a longer growth period.

The darker colors attended the shorter lengths of straw and the leaf area increased with the lighter colors, demonstrating that the plant through darker color economizes leaf surface. Straw length is primarily dependent on the leaf surface and the color of the species, and the strength of straw is dependent on color. The effect of color on culm length and strength is graduated according to the intensity of the tone.

Weight of grain and content of protein, dry matter, and ash increased according to the degree of darkness of color. The effect of the same color tone was different with different wheat species, and in like manner the effects of different colors on the same wheat species varied. With increasingly darker colors, the proportion of protein to dry matter and nitrogen-free material became greater.

Bare fallow wheat experiments, W. J. SPAFFORD and E. A. BRISTOW (*Jour. Dept. Agr. So. Aust.*, 24 (1921), No. 11, pp. 917-922).—In cultural experiments with wheat alternating with bare fallow, conducted at the Booborowie Experimental Farm, 1916-1920, bare fallowing the land in any manner gave increases of from 4 to 7 bu. of wheat per acre. The largest returns were obtained from fallow land prepared by plowing early, leaving the land rough throughout the winter, and cultivating or harrowing whenever necessary. Harrowing the land immediately after plowing apparently had a depressing effect, as it reduced the yield about 1 bu. per acre. Rolling "early" fallow immediately after plowing reduced the yield more than 3 bu. per acre. Skim plowing fallow land after

the first rain did not increase the wheat crop above that produced by ordinary fallow working.

Land plowed in July in preparing the bare fallow gave over 1 bu. of grain per acre more than land plowed in September. September plowing returned about equal yields whether the land was plowed shallow (3 in.) and not rolled, or plowed deep (6 in.) and heavily rolled the same day. The depth to which land was plowed between 3 in. and 9 in. had but little effect upon wheat yields.

The effects of premature harvesting on the wheat kernel, C. E. SAUNDERS (*Sci. Agr.*, 1 (1921), No. 2, pp. 74-77, fig. 1).—In an investigation of the effect of premature cutting on the wheat kernels, 1,100 heads of Marquis wheat, showing but few anthers, were marked on the same day. Starting on July 21, while the wheat was still perfectly green, 100 of these heads were gathered in groups, according to length of straw retained (3 in., half length, full length, and full length with roots) every second or third day until August 15, when the wheat was considered ready for ordinary harvesting. When all heads were hand thrashed in the fall after storage, the average weight of 1,000 kernels for the whole period from each group was as follows: 3 in., 23.034 gm.; half length (about 20 in.), 22.918 gm.; full length, 23.032 gm.; and full length with roots 23.254 gm., indicating that when the drying process is very rapid it is immaterial how much of the straw is retained.

The observations disclosed that during the early period of the development of the wheat kernel, 20 to 25 days before cutting in these experiments, the materials composing the grain are deposited at a rapid rate, which increases in speed until about 17 days before harvest. The rate remains stationary for a short time, then decreases suddenly, being reduced to almost nothing several days before the ordinary time of cutting in Ontario.

Analyses of kernels from heads cut on the several dates show that the percentage of protein decreased rapidly from July 21 to July 27, then slowly increased until about August 13. However, the actual amount of protein present increased rapidly from July 21 to August 6 and then increased more slowly until the end of the experiment, indicating that protein is deposited with much greater relative speed in the early stages of the kernel formation than later. Although the amount of protein added between July 21 and 30 was very great, other constituents, chiefly carbohydrates, were added even more rapidly. The period during which carbohydrates were deposited most rapidly, coincides with the time of rapid deposition of protein. Toward the end, both processes became much slower, but the deposition of both protein and carbohydrates did not cease until after August 15.

Provisions for seed inspection and certification, W. A. OSTRANDER (*Ind. Corn Growers' Assoc. Ann. Rpt.*, 20 (1920), pp. 73-78).—Regulations governing the inspection and certification of field crop seeds by the Indiana Corn Growers' Association are presented.

Report of the [Danish] State seed control in its forty-ninth year, 1919-20, K. DORPH-PETERSEN (*Tidsskr. Planteavl.*, 27 (1921), No. 3, pp. 451-494).—This report summarizes the activities and finances of the Danish seed control service and presents some of the principal lines of work. Tables are given showing the number of seed samples examined, together with their origin; the average results for the samples examined from 1910 to 1920, inclusive, and those examined in the year 1919-20; the number of samples above and below their guaranties as to purity, percentage of germination, and weed seed content; the seeds of injurious weeds and their frequency of occurrence in the seed samples; the injurious insects found in the seeds tested; and the average moisture content of the seeds by species.

The Danish State Seed Testing Station, 1871-1896-1921, K. DORPH-PETERSEN (*Statsfrøkontrollen (Dansk Frøkontrol), 1871-1921*). Copenhagen: [Govt.], 1921, pp. XVI+160, figs. 25).—Commemorating the fiftieth anniversary of the founding of the State Seed Testing Station by the late E. Møller-Holst, this report reviews the activities of the station during the period 1896-1921, outlines and discusses the regulations for seed analyses, and gives a list of publications issued since 1896. Work before 1896 has been noted elsewhere (E. S. R., 9, p. 55). Tabulations show for different periods the varieties sampled, average purity, germination and weed seed content, guaranties, and provenance of important varieties. F. Nobbe describes the work of the first seed testing station in existence, founded in 1869 by him at Tharandt, Saxony. Control methods in foreign countries are outlined, with the location, year of establishment, director, number of samples tested, and official status of the several stations indicated, and a bibliography of the literature generally used in seed testing.

Dry spraying for the destruction of charlock, W. A. MILLARD and S. BURR (*Jour. Min. Agr. [London]*, 28 (1921), No. 2, pp. 134-142, pl. 1).—In trials of various powdered substances for the eradication of charlock, copper sulphate gave excellent results; iron sulphate was effective only in such quantities as were prohibitive in cost; and nitrolim was valueless. Where seed is not set, 20 lbs. of finely ground copper sulphate per acre is sufficient to destroy charlock. The best effects will probably be obtained when the plant is bursting into flower, as the flower-heads are easily killed and the leaf surface exposed to the dust is greater than with younger plants. When the weather is fairly settled with a heavy dew and no wind at the time of application, dusting is said to be quite as effective as ordinary spraying.

HORTICULTURE.

California nurserymen and the plant industry, 1850-1910, E. J. WICKSON (*Los Angeles: Calif. Assoc. of Nurserymen, 1921, pp. 55, pl. 1*).—A series of addresses delivered before the California Association of Nurserymen from 1916 to 1920 containing information relating to the history and development of horticulture in California, with special reference to prominent nurserymen and important plant introductions. A brief biographical sketch of the author by H. W. Kruckeberg is included.

The heredity of "rogue" types in garden peas (*Pisum sativum*), W. BROTHERTON, JR. (*Mich. Acad. Sci., Ann. Rpt.*, 21 (1919), pp. 263-279, pls. 7, fig. 1).—A genetical study of offtypes originating by mutation within certain horticultural varieties of *P. sativum*. These abnormal types, known as rabbit-ear rogues and characterized by taller and ranker plant growth, narrower foliage, different flowering periods, smaller flowers, and narrower and more curved pods, are particularly undesirable on account of the bitter flavor of the peas. The occurrence of an intergrading type in which the lower part of the plant is normal and the upper abnormal is noted.

Crosses between rabbit-ear rogues and type plants within the Gradus variety yielded progeny, all of which even to the F_3 generation were similar in appearance to the abnormal parents. Similar results obtained with other varieties indicated the complete dominance of the rabbit-ear rogue. The progeny of rogues crossed with rogues were all of this offtype.

Determinations of the mean ratio of the length to width in stipules of type, rogue, and hybrid F_1 plants indicated the greatest variability in the F_1 and the least in the type plants.

Crosses between Gradus rogues and normal plants of Peter Pan and Thomas Laxton, both rogue-producing varieties, yielded all rogues. Crosses of type and rogue plants of Peter Pan gave similar results. However, in crossing rogues with type plants of nonmutating varieties, an intermediate type was produced which in the F_2 segregated into several different types.

Insecticides and fungicides for farm and orchard crops in Massachusetts, E. B. HOLLAND, A. I. BOURNE, and P. J. ANDERSON (*Massachusetts Sta. Bul.* 201 (1921), pp. IV+37, pl. 1; pop. ed., pp. 16, pl. 1).—A presentation and discussion of data relative to the composition and effective use of various insecticides and fungicides. Standard formulas for preparing the mixtures are included, together with a diagram, adapted from a circular by Gray, previously noted (E. S. R., 39, p. 39), illustrating safe and dangerous combinations of materials. A table showing the guaranties of a number of proprietary articles is appended.

Root development in newly planted trees, B. T. P. BARKER (*Univ. Bristol, Agr. and Hort. Research Sta. Ann. Rpt.*, 1920, pp. 43-60, pls. 3; also in *Jour. Bath and West and South. Counties Soc.*, 5. ser., 15 (1920-21), pp. 175-194, pls. 3).—The initial report on a study of root development of fruit trees, presenting observations on one year's growth of Paradise-rooted apple trees in three different media, soil, sand, and water.

Five different root treatments are involved: (1) All fibrous roots carefully preserved, (2) fibrous roots preserved but tree rammed at planting according to the method discussed by Pickering (E. S. R., 35, p. 37), (3) all fibrous roots removed, (4) similar to (3) except that roots were deliberately slashed, and (5) all branch and fiber roots removed, leaving only a short stump root. In order to study the effect of top pruning, each of these five groups was subdivided, one-half of the trees being pruned and one-half unpruned. The trees grown in sand and water were placed in tubs, were all pruned, and were, with the exception of some of the water-grown trees, supplied with nutrient solutions.

Examination of one year's growth indicated in general that the treatment to which the trees were submitted at planting had no material effect on the manner of root renewal. In the case of the soil-grown trees, practically no use was made of the old root system, all the new roots emanating from that portion of the main stock situated in the upper 3 to 4 in. of soil. Root formation in sand was characterized by a prolific development of fine thread-like roots along the entire length of the main stock. The few roots produced in water were of greater diameter but much shorter than those produced in sand, and the shoot and foliage development was correspondingly meager and unsatisfactory.

Aeration is believed by the author to be the determining factor in the manner of root development in the three media, and he points out that the most vigorous and extended growth took place in sand, where excellent aeration existed. Furthermore, it is believed that with Paradise stocks such as were used in the experiments the style of root pruning is of little importance, in that under ordinary planting conditions the fibrous roots are unable to renew their growth following transplanting.

It is urged that greater care should be exercised in the selection of well-drained soils for the orchard and in improving drainage conditions on established plantations.

Factors governing fruit-bud formation, B. T. P. BARKER and A. H. LEES (*Univ. Bristol, Agr. and Hort. Research Sta. Ann. Rpt.*, 1920, pp. 19-42; also in *Jour. Bath and West and South. Counties Soc.*, 5. ser., 15 (1920-21), pp.

151-175).—This article, a continuation of the series (E. S. R., 43, p. 742), presents a critical study of the Lorette system of pruning, described in a previously noted paper (E. S. R., 41, p. 238). Pointing out the difficulty in accurately translating the directions of Lorette, the authors discuss those sections of the system which deal with pruning as a factor in fruit-bud formation, and present the results of a practical test at Long Ashton, Bristol. Loeb's hypothesis of growth inhibition is believed by the authors to be an important factor in explaining the results. The Lorette system is considered of value when practiced by trained horticulturists, but requiring modification when applied to ordinary commercial practices. Positive results may be expected only under conditions similar to the original ones.

Fruit breeding investigations, G. T. SPINKS (*Univ. Bristol, Agr. and Hort. Research Sta. Ann. Rpt.*, 1920, pp. 61-65; also in *Jour. Bath and West and South. Counties Soc.*, 5. ser., 15 (1920-21), pp. 138-143).—In continuation of previous reports relating to plant-breeding activities at Long Ashton (E. S. R., 43, p. 742), records are given of the parentage of successful pollinations in 1920 with the apple, pear, plum, raspberry, miscellaneous *Rubus* species, currant, gooseberry, and strawberry, including a statement of the desired objectives. Observations on F₁ generation tomato seedlings showed that in general these were intermediate in type between the parents. The individuals of any particular cross were observed to be apparently identical.

Studies with apple and pear pollen, R. FLORIN (*Acta Horti Bergiani [Upsala]*, 7 (1920), No. 1, pp. 39, pl. 1; rev. in *Deut. Obstbau Ztg.*, 67 (1921), No. 19, pp. 88, 89).—Detailed records are presented in tabular form of a Swedish investigation of the viability and potency of the pollen of 102 apple and 14 pear varieties, as indicated by development in sugar solutions of 2.5, 5, and 10 per cent concentrations.

Separating the varieties into three groups according to the percentage of viability of their pollen, the author places 24 apples and 9 pears in group 1 (0 to 30 per cent), 13 apples and 2 pears in group 2 (31 to 70 per cent), and 65 apples and 3 pears in group 3 (71 to 100 per cent). Potency records, indicated by measurements of the length of the pollen tubes, as given for most of the varieties, show in general that apple pollen is more potent than pear pollen.

A bibliography of 27 titles is included. The review is by Ebert.

Pollination in orchards.—IV, **Self-fertility and self-sterility in plums**, A. N. RAWES (*Jour. Roy. Hort. Soc.*, 46 (1921), pp. 353-356, pls. 4).—A further contribution from the Wisley laboratory on the general subject (E. S. R., 31, p. 337).

Of 18 varieties of *Prunus domestica* tested relative to self-fruitfulness, 11 were found self-sterile and 3 fully and 4 partially self-fruitful. The results of a comparative study of cross *v.* self-pollination, presented in tabular form, indicated that crossing stimulated a larger set but had no apparent influence on the size, shape, color, and time of maturity of the fruits. Incompatability was observed in attempted crosses between President and Late Orange. In an examination involving 16 varieties the pollen of Frogmore Orleans was observed to contain the least percentage of imperfect grains. The order of blooming of the 18 varieties is shown in tabular form.

Strawberries in Connecticut, W. H. DARROW (*Conn. Agr. Col. Ext. Bul.* 42 (1921), pp. 26, figs. 18).—An illustrated pamphlet presenting practical information relative to culture, varieties, and marketing.

A method of identifying reversion of black currants, A. H. LEES (*Univ. Bristol, Agr. and Hort. Research Sta. Ann. Rpt.*, 1920, pp. 66-70, pl. 1; also in *Jour. Bath and West and South. Counties Soc.*, 5. ser., 15 (1920-21), pp. 133-

138, *pl. 1*).—A practical means of detecting reversion in the black currant (E. S. R., 42, p. 150) is described, based on abnormalities in the venation and margination of the leaves of diseased plants. Such leaves were found to possess fewer veinlets extending from the midvein to the margin, and the margin was found to possess fewer indentations and to be more coarsely serrate, sometimes in extreme cases approaching a distinctly crenate form. Utilizing this method of detection, it is recommended that growers propagate only from completely normal plants and that all diseased material be rogued and burned.

Vineyard irrigation in arid climates, F. T. BIOLETTI (*California Sta. Circ.* 228 (1921), *pp. 4*).—Following a discussion of the principles underlying successful irrigation, instructions are given for watering both young and fruiting vines under arid conditions such as exist in the Imperial Valley.

Status of California grape industry June 30, 1921, R. L. NOUGARET (*Calif. Dept. Agr., Vitic. Serv. Rpt. 2* (1921), *pp. 40, fig. 1*).—A statistical report on grapes and grape products in 1920, with a discussion of prospects for the grape industry.

Muscadine grapes and grape products, C. DEARING (*Fla. State Hort. Soc. Proc.*, 33 (1920), *pp. 146-153*).—A review of the activities of the U. S. Department of Agriculture in the improvement of the Muscadine grape (E. S. R., 37, p. 544) and in the utilization of its fruit (E. S. R., 38, p. 114).

Grape improvement investigations in Prussia, K. KROEMER (*Landw. Jahrb.*, 51 (1918), *No. 2, pp. XV+292, pls. 8, figs. 43*).—This is a comprehensive review of grape improvement activities in Germany during the period 1880-1915, particularly in reference to breeding and grafting experiments with American stocks in an effort to combat phylloxera. The subject is handled in two general divisions entitled (1) development and technique of grape improvement and (2) Government experiment stations devoted to grape improvement.

Guatemalan and Mexican avocados fruiting in Florida, J. B. BEACH (*Fla. State Hort. Soc. Proc.*, 33 (1920), *pp. 60-65*).—Brief observations are given on several varieties of avocados which show promise in Florida.

Experiments on the manuring of coconuts at Long Island, P. R. DUPONT (*Seychelles Agr. and Crown Lands, Ann. Rpt.*, 1920, *p. 5*).—In confirmation of previously noted results (E. S. R., 45, p. 239), the largest yields of coconuts were again produced on plats receiving applications of potash bearing fertilizers.

[Manurial and budding experiments with limes] (*West Indies Imp. Dept. Agr., Dominica Agr. Dept. Rpt.*, 1919-20, *pp. 22-26*).—In a fertilizer test involving five treatments, namely, (1) complete fertilizer, (2) control, (3) mulch, (4) nitrogen and potash, and (5) nitrogen and phosphoric acid, the largest average yield over a three-year period was obtained from the complete fertilizer plats. A comparison of budded *v.* natural roots indicated that budding on sour orange stocks favored an earlier and larger yield. The use of the common and M'gergeb citrons as stocks resulted in such poor growth that the test was discontinued, leading to the conclusion that the citron is of no value as a stock for the lime.

The Eustis limequat, a new bardy lime, T. R. ROBINSON (*Fla. State Hort. Soc. Proc.*, 33 (1920), *pp. 98-100*).—Attention is directed to the potential possibilities of this recently named citrus novelty, of lime kumquat parentage. The flavor is said to closely resemble that of the lime and the plant to be like the kumquat in ability to resist diseases, insects, and low temperatures.

Nut growing, R. T. MORRIS (*New York: Macmillan Co.*, 1921, *pp. VIII+236, pls. 16*).—A treatise in three parts, the first devoted to a general discussion of the subject; the second to culture, propagation, and breeding; and the third

to species and varieties. Methods of grafting and budding are described and illustrated.

Pecan culture in Florida, C. A. REED (*Fla. State Hort. Soc. Proc.*, 33 (1920), pp. 101-108).—A paper on the possibilities of pecan growing in Florida, stressing the importance of good fertility, proper methods of planting, and selection of adaptable varieties.

Michigan an important source of raw vegetable products, H. KRAEMER (*Mich. Acad. Sci. Ann. Rpt.*, 21 (1919), pp. 167-199).—A general discussion of medicinal and aromatic plant production in the United States. Notes are given on the behavior of 50 species grown in the University of Michigan botanical gardens.

Lagerstroemia, S. PERCY-LANCASTER (*Agr. and Hort. Soc. India, Proc.*, 1920, Jan.-June, pp. 19-21).—A brief descriptive account of several species and varieties, one of which, *L. indica*, is used in the United States as a decorative shrub.

Planting and care of street trees, F. L. MULFORD (*U. S. Dept. Agr., Farmers' Bul.* 1209 (1921), pp. 35, figs. 25).—The information herein presented is included in a previously noted bulletin by the same author (*E. S. R.*, 42, p. 538).

FORESTRY.

Forest experiment stations, E. H. CLAPP (*U. S. Dept. Agr., Dept. Circ.* 183 (1921), pp. 34, figs. 9).—A circular of information emphasizing the need of more forest experiment stations, pointing out some of the work already performed, and drawing attention to the many fundamental problems which must be solved before forestry can materially advance.

Handbook of Yosemite National Park, compiled and edited by A. F. HALL (*New York and London: G. P. Putnam's Sons*, 1921, pp. XIII+347, pls. 26, figs. 12).—A collection of articles on the Yosemite National Park, grouped together in the form of an attractive handbook, including *Trees of Yosemite National Park*, by A. F. Hall (pp. 219-234); and *The Giant Sequoia* (pp. 235-246) and *Flowers of the Yosemite National Park* (pp. 247-267) both by W. L. Jepson. A key to the cone-bearing trees of Yosemite National Park (pp. 329-332) is included in the appendix.

Report of forestry branch, 1920 (*Ontario Min. Lands and Forest Rpt.*, 1920, pp. 207-235, figs. 11).—A report, similar to that of the preceding year (*E. S. R.*, 45, p. 239), of the activities of the forestry branch for the year ended October 31, 1920, including forest protection, reforestation, and a report by J. H. Faull on forest pathology. A survey was begun during the year, the data from which, presented in tabular form, show a total of nearly 1,700,000 acres examined.

The forestry service (*Netherlands East Indies Yearbook*, 1920 (*Eng. ed.*), pp. 126-138, pls. 3).—A general review of forest activities in the Dutch East Indies since the establishment of the forest service, with reference to organization, management, protection, and research. Tabular data are given relative to the annual production and exportation of teak, which is considered by far the most valuable species, so much so that all others are classed as wild timber.

The eco-dendrological problem of the production of forest seeds, G. BORGHESEANI (*Riv. Biol.*, 1 (1919), No. 5-6, pp. 559-585, figs. 6; *abs. in Internatl. Inst. Agr. [Rome], Internatl. Rev. Sci. and Pract. Agr.*, 11 (1920), No. 5, pp. 600-602).—A review of the investigations of various European scientists upon the effect of the place of origin of forest seeds upon the resulting trees.

A note on the fall of winged seeds, H. J. DENHAM (*Quart. Jour. Forestry*, 15 (1921), No. 4, pp. 247-252).—A study of the rate and manner of the fall

through the air of the seeds of 18 conifers and dicotyledons, with a view to enlightenment relative to seed dispersal in the forest.

Drought and reforestation, H. JOLYET (*Vie Agr. et Rurale*, 10 (1921), No. 36, pp. 153-158, figs. 4).—Basing his observations on the behavior of various forest species over a period of very dry years in which reforestation has been difficult on account of the loss of young, newly planted, and shallow-rooted trees, the author discusses methods and materials for reforestation under such conditions. Three coniferous species, *Pinus austriaca*, *Pseudotsuga taxifolia*, and *Picea excelsa*, are deemed of value, but it is suggested that these be interplanted with *Robinia pseudacacia* or some other broad-leaf species. Pointing out the variations existing in *P. excelsa*, the author recommends that seeds be gathered from parent trees which have proved their adaptability to dry environment.

Farms v. forests, P. S. LOVEJOY (*Mich. Acad. Sci. Ann. Rpt.*, 21 (1919), pp. 201-212).—This article points out the existence of vast areas of unprofitable cut-over lands in Michigan and urges their classification as to adaptability for agriculture or forestry.

Forest planting on the farm, S. N. SPRING and C. H. GUISE (*Cornell Reading Course for the Farm*, No. 159 (1921), pp. 40, figs. 15).—Practical directions are given relative to the selection of species, planting methods, and the care of plantations, together with descriptive notes of the more important species and comments on the financial phases.

Farm forestry, J. H. M. HOME (*Highland and Agr. Soc. Scot. Trans.*, 5. ser., 33 (1921), pp. 43-55).—A presentation of information for the small landowner relative to windbreaks, management of woodlands, desirable species, and planting.

Some remarks on the establishment and tending of timber plantations with special reference to the Cape Province, J. J. KOTZE (*So. African Jour. Nat. Hist.*, 3 (1921), No. 1, pp. 145-173, fig. 1).—A general statement relative to selection of site, planting, management, and characteristics of available species.

Forest flora of the Italian lake region, F. G. D'ALVIELLA (*Bul. Soc. Cent. Forest. Belg.*, 27 (1920), No. 12, pp. 573-589, figs. 3).—A descriptive account of forest tree species, native and introduced, with a general statement relative to climate, soils, and silvicultural practices.

The deciduous oaks of northern Africa, G. LAPIE (*Vie Agr. et Rurale*, 10 (1921), No. 36, pp. 159-162, figs. 4).—Botanical descriptions are given for two oak species, *Quercus mirbeckii* and *Q. afarès*, said to constitute beautiful forests in Northern Africa. Reference is also made to distribution, natural hybrids, exploitation, and utilization.

The alahoe tree, C. S. JUDD (*Hawaii. Forester and Agr.*, 18 (1921), No. 6, pp. 133-137, figs. 3).—A brief account of a small Hawaiian tree, *Plectronia odorata*, the wood of which, on account of its peculiar toughness, was at one time utilized in place of stone in the manufacture of implements.

Rubber plants, H. M. HALL and F. LONG (*Carnegie Inst. Wash. Yearbook* 19 (1920), pp. 365, 366).—During three years 250 species have been examined for rubber. The results show that rubber occurs in a much larger number of species than heretofore supposed, the amount present in some cases being sufficiently great to justify commercial tests. Species of *Asclepias* appear to be the most promising.

Results obtained with budded trees of *Hevea brasiliensis* on Pasir Waringin estate, W. VISCHER (*Arch. Rubbercult. Nederland. Indië*, 5 (1921), Nos. 1, pp. 17-39, pls. 2, figs. 5; 2, pp. 43-45).—On the basis of anatomical studies of bark samples taken at the union of the stock and scion of young budded

trees, the author found that the number of rows of latex vessels in the scion is for the greater part independent of the number in the stock.

Correlation between yield and number of latex vessel rows of *Hevea brasiliensis*, W. BOBILIOFF (*Arch. Rubbercult. Nederland. Indië*, 4 (1920), No. 8, pp. 383-391, figs. 2).—A fair degree of correlation (0.55 ± 0.051) was found to exist between the yield and the number of latex vessels in a total of 491 trees used in the study.

Some further data on the influence of tapping on latex and rubber, O. DE VRIES (*Arch. Rubbercult. Nederland. Indië*, 4 (1920), No. 7, pp. 313-334).—In continuation of investigations previously noted (E. S. R., 41, p. 542), the author discusses the effect of variations in the methods of tapping on the quality of the latex and rubber.

Lengthening of the incision resulted in a decrease of the rubber content and an increase of the specific gravity of the latex. A similar result was obtained by increasing the number of cuts on one tapping surface. Cuts made on opposite sides of the tree at different elevations gave different yields of identical properties. An English summary is presented with the paper.

The anatomical structure of the latex-vessel system in relation to the latex yield, W. VISCHER (*Arch. Rubbercult. Nederland. Indië*, 4 (1920), No. 9, pp. 473-494, pls. 2, figs. 7).—A report, summarized in English, relative to the location and movement of the latex in *Hevea brasiliensis* and to the connections between the lactiferous system of the roots and the stem.

It was found that, while most of the vessels of the root are directly connected with those of the trunk, their capacity is far less than that of the trunk vessels. Tapping was found to influence the movement of the latex at one meter distant from the cut. In comparing the yield from two incisions, one directly above the other, it was observed that the yield of the upper was materially less, thus indicating the inadvisability of tapping in this manner.

DISEASES OF PLANTS.

Plant diseases of the year, A. V. OSMUN (*Massachusetts Sta. Rpt.*, 1920, pp. 20a-22a).—Brief accounts are given of plant diseases which have been under observation during the period covered by the report.

A bacterial disease of tobacco, known in the southern part of the United States as wildfire, was observed for the first time in the State, although there is believed to be evidence that it has been present for at least two years. The leaf spot of tomato, caused by *Septoria lycopersici*, which has been noted on other occasions in greenhouses in the State, was reported for the first time as occurring out of doors in Massachusetts. A carrot disease, which appeared to be a new one, was investigated to some extent, and although the cause has not been definitely determined, it is believed to be due to some fungus. A disease of eggplant reported in 1919 was again observed in 1920 in a section of land where the disease had occurred the previous year, and the cause of the trouble was definitely determined to be a species of *Verticillium*. Late blight of potato was prevalent and favored by abnormal weather conditions. Fields that were carefully and systematically sprayed with homemade Bordeaux mixture are said to have suffered the least.

Plant diseases [in Ontario] (*Ontario Min. Agr. Rpt.*, 1919, p. 13).—New diseases of plants investigated included eggplant wilt, lettuce rust, and tomato stem rot.

[Plant diseases], A. HERNANDEZ (*Philippine Bur. Agr. Ann. Rpt.*, 19 (1919), pp. 50-54, pls. 2).—The diseases here reported on include abaca (*Musa textilis*) heart rot (which is thought to be identical as to cause with the coconut bud rot

(*Phytophthora faberi*); cacao black rot (*P. omnivora* and *Lasiodiplodia theobromae*); citrus pink disease (*Corticium salmonicolor*), the worst disease of citrus at the Lamo Horticultural Station; and foot rot or mal di gomma in some citrus trees at the station. Rose rust in the rose gardens at Singalong and Pasay was controlled by Bordeaux mixture.

Abaca root rot, apparently due to soil toxins and not primarily to organic causation, is thought to cause most of the abaca diseases in Paete and Silang.

Diseases new or little known in France, II. G. ARNAUD (*Min. Agr. [France], Ann. Serv. Épiphyties*, 6 (1918), pp. 214-227, figs. 11).—This discussion, continuing that previously noted (E. S. R., 40, p. 844), deals with lilac diseases attributed to *Phytophthora syringae*, *Botrytis cinerea*, *Heterosporium syringae*, and associated or undetermined fungi; a maple disease due to *Cercospora acerina*; black hellebore diseases (*Entyloma ranunculi* and *Coniothyrium hellebori*); leaf spot (*Fusicladium eriobotryae*) of Japanese medlar; and potato scab (*Oospora scabies*) and Rhizoctonia disease.

Studies in bacteriosis.—V. Further investigation of a suggested bacteriolytic action in *Protea cynaroides* affected with the leaf-spot disease, S. G. PAINE and E. M. BERRIDGE (*Ann. Appl. Biol.*, 8 (1921), No. 1, pp. 20-26, fig. 1).—Continuing the series of studies by Paine with others (E. S. R., 44, p. 647), the authors have studied phenomena suggesting a bacteriolytic process analogous to that found in animals, also the fate of the bacteria after they have invaded the leaf and produced the leaf spot. The causal organism may be *Pseudomonas proteamaculans*. The production by the cells of the host plant (*Protea cynaroides*) of a bacteriolysin against the leaf-spot organism was not confirmed. The bacteria enter the leaf by way of the stomata. The formation of wound cork prevents the spread of the infection.

Two serious new wilt diseases, T. G. B. OSBORN (*Jour. Dept. Agr. So. Aust.*, 23 (1919), No. 5, p. 437).—Late in 1919 a spotted wilt of tomato first came to notice as being serious, though known in Victoria for two or three years. A wilt of strawberry also showed virulence in the Hills district about the same time.

Wheat foot rot, E. FOEX (*Min. Agr. [France], Ann. Serv. Épiphyties*, 6 (1918), pp. 200-213, pls. 3).—Foot rot, associated with *Ophiobolus herpotrichus*, *O. graminis*, and *Leptosphaeria herpotrichoides*, is here discussed chiefly in connection with the last named of these fungi. This account deals with the emission and germination of ascospores and the behavior of the mycelium of *L. herpotrichoides*, also with cultural studies and artificial infection of young wheat plants. The other fungi are briefly discussed.

Early seeding apparently favors attack by foot rot. The different effects of alternating with various plants, also of using fertilizers, are discussed in connection with the nitrogen supply.

Iron sulphate on wheat seed following wheat was not very effective, but was more so on wheat seed following beets, particularly when the stronger concentrations were used.

The effects of free tillering are usually so combined with the influence of nitrogenous materials in the soil that it is difficult to estimate the influence of tillering alone on foot rot.

A bacterial disease of carrot, G. DAUMÉZON (*Min. Agr. [France], Ann. Serv. Épiphyties*, 6 (1918), pp. 327-330, fig. 1).—During 1915 and 1916, and to a less degree in 1917 and 1918, carrots on low and humid lands of Narbonne were attacked by a bacterial rot, supposedly due to *Bacillus carotovorus*.

Potato leaf roll, E. BLANCHARD and C. PERRET (*Min. Agr. [France], Ann. Serv. Épiphyties*, 6 (1918), pp. 320-326).—Studies on potato leaf roll in 1918, continuing those previously noted (E. S. R., 41, p. 656) and attempting to inves-

tigate the various phases of the disease in several varieties differing as to resistance, include the effects of nitrogenous fertilizers, distribution of crops, and use of fungicides, with the results of tests for varietal resistance.

It appears that the malformation is due to a deficiency of nitrogen amounting to nitrogen starvation. It is thought that the trouble is caused by the deprivation of nitrogen in its double capacity of furnishing various albuminoid and other nitrogenous materials and of promoting development in the parenchymal structures connected with intensive nutrition.

Control of spinach leaf mold (downy mildew) by spraying, L. B. SMITH (*Va. State Crop Pest Comm. Quart. Bul.*, 3 (1921), No. 1, pp. 4, fig. 1).—Spinach near Norfolk, Va., is seriously injured each autumn and winter by downy mildew, locally known as leaf mold, due to *Peronospora effusa*. This is apt to be followed in the spring by leaf spot due to attack by *Heterosporium variabile* on the weakened plants. Reports of Reed and Cooley (*E. S. R.*, 25, p. 846) are cited in this connection. The effects on the appearance of the plants are described.

The most serious outbreak of leaf mold in several years resulted from weather favorable thereto in the autumn of 1918. The disease was first observed October 16, and sprays were applied October 22 and 30 from a sprayer maintaining a pressure of 100 lbs. per square inch. The two plats showing perceptibly lowered percentages (72 and 89) of infection were those sprayed with copper sulphate and fish oil soap mixtures, made up to strengths corresponding to 0.25 copper sulphate and 5 lbs. soap to 50 gals. water, and to 0.125 and 3 lbs. to 50 gals., respectively.

Diseases of sugar cane in the Philippines, O. A. REINKING (*Sugar Cent. and Planters News*, 1 (1920), Nos. 14, pp. 22-30, 35-39, 43, figs. 7; 15, pp. 16-20; 16, pp. 18-22).—Extensive damage is done by fungus diseases of sugar cane in the Philippines, which have, in fact, a large part of the fungus diseases found in the sugar-producing parts of the world. Close planting is very conducive to loss from such causes.

Diseases listed with brief discussion include blight (*Rhizoctonia* sp.) dry sooty rot (*Lasiodiplodia theobromae*), leaf splitting (*Sclerospora* sp.), leaf spots (*Bakerophoma sacchari*, *Cercospora kopkei*, and *Phyllachora sacchari*), mosaic or yellow stripe, pineapple disease (*Thielaviopsis paradoxa*), red rot (*Colletotrichum falcatum*), rind disease (*Melanconium sacchari*), root disease (*Dictyophora phalloidea*), root and stem disease (*Marasmius* sp.), root parasite (*Aeginetia indica*), rust (*Puccinia kuehnii*, *Uredo kuehnii*), sereh disease, smut (*Ustilago sacchari*), sooty mold (*Meliola arundinis*), stem rot (*Sclerotium* sp. and bacteria), various fungi found mostly on dead material, black rot (*Sphaeronema adiosum*), collar rot (*Hendersonia sacchari*), gumming disease (*Bacterium vascularum*), iliau disease (*Gnomonia iliau*), leaf stripe (*Sclerospora sacchari*), mosaic or yellow stripe, root rot (*Pythium debaryanum*), wilt (*Cephalosporium sacchari*), helminthosporiose (*Helminthosporium sacchari*), knife cut (physiological), leaf scald, ring spot (*Leptosphacteria sacchari*), and Fiji disease.

The Fiji disease of sugar cane, R. J. HASKELL (*Trop. Agr. [Ceylon]*, 56 (1921), No. 6, pp. 381-383).—Fiji sugar cane disease, said to have been known in the Fiji Islands at least as early as 1905, occurs also in New Guinea, in New South Wales, and on Mindoro, Philippine Islands. Brief notes are given herein based on accounts from various sources, also regarding the serious character, symptoms, and causation of the disease, which is said to be due apparently to an organism somewhat similar to *Plasmodiophora brassicae*. Marked differences as regards varietal susceptibility are noted in canes, a number of which are being studied from this standpoint.

Fiji disease of sugar cane, O. A. REINKING (*Sugar Cent. and Planters News*, 2 (1921), Nos. 2, pp. 41-48, 56, figs. 10; 3, pp. 94-102; 8, pp. 335, 336).—Fiji disease of sugar cane is said to have been present in several sugar sections of the Philippines for some years, having been identified as such in December, 1920, and found in Mindoro and Calamba in Luzon. Observations are outlined and control measures suggested.

The causal organism has not been identified, though distinct plasmodial bodies are in old and in young galls. Apparently the organism enters the cane through the roots. The Philippine cane varieties are less affected than are foreign varieties. Cuttings, though apparently healthy, may carry the disease. Control measures, regarded as preliminary, include sanitation, rotation, and seed selection. Late experiments are said to have shown that Fiji disease is transmitted in diseased cuttings and is controllable by seed selection.

Fiji disease of cane, O. A. REINKING (*Facts About Sugar*, 12 (1921), No. 14, pp. 272, 273).—This is a condensation of information on this subject as contained in the articles noted above.

Mosaic disease of sugar cane (*Fla. Plant Bd. Bien. Rpt.*, 3 (1919-20), pp. 67-71, 89, 90).—An account is given of the discovery in 1919 that sugar cane mosaic had been distributed from the Louisiana Sugar Experiment Station, at Audubon Park, New Orleans, to points in Louisiana and other Southern States. It appeared at 15 points in 13 counties of Florida. The campaign to destroy affected cane is outlined, with details of quarantine and cooperative measures.

The presence of what is called the pineapple disease of seed canes in the Philippines, H. A. LEE (*Sugar Cent. and Planters News*, 1 (1920), No. 12, pp. 1-5, 11, figs. 3).—Pineapple disease (*Thielaviopsis paradoxa*) is said to be the most serious fungus disease of sugar cane in the Provinces of Pampanga, Bulacan, Rizal, Laguna, and Batangas. Preventive measures are outlined.

Sugar cane smut, H. A. LEE (*Sugar Cent. and Planters News*, 1 (1920), No. 13, pp. 21-24, 28, figs. 2).—Sugar cane smut (*Ustilago sacchari*) is said to be general throughout the Philippines at this time, constituting the most serious obstacle to ratooning, particularly of the varieties Luzon White and Pampanga Red. Affected canes may constitute as much as 50 per cent of the stools.

Top-rot disease of cane, H. A. LEE and M. G. MEDALLA (*Sugar Cent. and Planters News*, 1 (1920), No. 14, p. 56).—A study, during six months, of a cane disease apparently epidemic in Laguna Province in the Philippines appears to prove this identical with cane top rot of Java. Inoculation studies show also that the disease is transmissible.

Yellow-stripe disease of cane in the Philippines, H. A. LEE and M. G. MEDALLA (*Sugar Cent. and Planters News*, 1 (1920), Nos. 13, p. 36; 14, pp. 12-17).—Yellow stripe or mosaic of sugar cane, noted by Lee in the first of these articles as present in the Philippines and so prevalent as to suggest its previous development during a long term in that region, is said in the second part to be distributed throughout Rizal, Laguna, and Batangas and of equal importance with smut and top rot. The account includes a description of the disease, injury caused thereby, causation of the disease and possible measures of control, and its distribution in other countries. The preventive measures suggested include precautions tending to reduce transmission by insects, elimination of related grasses, and selection of seed free from disease and of resistant varieties.

Infection of tomatoes by *Septoria lycopersici*, C. KILLIAN (*Min. Agr. [France]*, *Ann. Serv. Épiphyties*, 6 (1918), pp. 334, 335).—Observations outlined regarding the beginning and development of infection of tomato by *S. lycopersici* and conditions related thereto show the importance of removing

completely in autumn all infected tomato leaves from ground which is to be used for tomato culture.

The apple tree anthracnose, H. P. BARSS (*Oreg. Grower*, 1 (1920), No. 12, pp. 4, 5, figs. 2).—Observations indicate unusual severity of attack by apple tree anthracnose in some orchards during the winter of 1919–20, although this is regarded as the only serious canker trouble now prevalent in Oregon. The outbreak appeared to have been greatly favored by conditions following unusually low temperatures. Surgical treatment and use of Bordeaux mixture previous to the beginning of the dormant period, and special attention in the spring, are considered as necessary.

Some factors influencing the practical control of blister canker in apple orchards, H. W. ANDERSON (*Amer. Soc. Hort. Sci. Proc.*, 17 (1920), pp. 111–116).—In an attempt to control blister canker in Illinois, factors found to be of fundamental importance included, as regards etiology, the source and manner of infection and the life of the fungus in the host; as regards the host itself, susceptibility and conditions favoring infection. These factors are here dealt with in detail, and a plan is formulated in agreement with the methods indicated as appropriate. These include avoidance of susceptible varieties, as Ben Davis and Gano, annual surveys, and destruction of infected trees if the orchard is young or treatment in case of orchards aged 15 years or older.

The seed content and the position of the fruit as factors influencing stippen in apples, A. J. HEINICKE (*Amer. Soc. Hort. Sci. Proc.*, 17 (1920), pp. 225–232).—Bitter pit developed unusually during 1920 at the New York Cornell Experiment Station, being especially prevalent on apples of mature Baldwin trees growing in a sod orchard.

Studies here indicated referred to the position of the fruit on the cluster base, the location of the fruit spur on the branch, the nature of the bearing wood, the relation between the occurrence of bitter pit at the time of harvesting and the seed content of the apple, the development of bitter pit after harvesting and its relation to the seed content, the condition of the nonpitted tissues of the affected apple, and the occurrence of water core.

Bitter pit seems to be associated with conditions favorable to incipient wilting, but unfavorable to an abundant, or even an adequate, supply of nutrients, such conditions being found on weak spurs near the base of a branch, in small lateral apples that are competing with other fruits in the same cluster, and in fruits or portions of a fruit having a poor seed content. Surfaces exposed to direct sunlight become heated and may transpire excessively. The form of stippen which does not show until after harvest seems to be associated with conditions favoring an abundant or excessive supply of water and nutrients tending to increase size. These conditions exist in central fruits and in many seeded fruits borne on strong spurs located near the ends of relatively vigorous wood.

So-called true bitter pit is thought to be due to the same causes as those producing stippen. Both may be regarded as a kind of drought or starvation spot. Seeds and other factors bear a relation to stippen, supposedly because they play a part in incipient wilting and because they help to determine the distribution of water and nutrients, thereby affecting the susceptibility of tissue.

An old disease in a new place, W. L. HOWARD (*Amer. Soc. Hort. Sci. Proc.*, 17 (1920), pp. 102–104).—During the previous four or five years losses had been caused to apricot growers in coastal or coastal valley areas in California having poor air drainage, due to a disease which was identified as *Sclerotinia fructigena*. In 1920 the yield reduction averaged about 30 per cent.

Experimental sprayings in 1920 showed that the best results were obtained from applications made near blooming time, employing lime sulphur 1:10, dry lime sulphur 12:50, or Bordeaux mixture 4:5:50 if the trees were sprayed after the fruit buds were noticeably swollen. Crude oil emulsion, as applied in winter to control brown apricot scale (*Lecanium corni*), promises to control brown rot if applied after the buds begin to swell. Self-boiled lime sulphur is toxic to apricots. Brown rot also attacks moderately both peach and prune under similar conditions.

Specialization in *Monilia* on cherry, C. KILLIAN (*Min. Agr. [France], Ann. Serv. Épiphyties*, 6 (1918), pp. 331-333).—Evidences suggest that the sour cherry was the original and the sweet cherry a derived form, and that the form of *Monilia* found on sweet cherry has arisen during a process of adaptation within the period of artificial culture.

Fig branch disease, A. PRUNET and B. AGGÉRY (*Min. Agr. [France], Ann. Serv. Épiphyties*, 6 (1918), pp. 175-186, figs. 3).—The disease which was noted previously by the senior author (E. S. R., 15, p. 52) as due to a Botrytis, and which is said to be more or less prevalent throughout southwestern France, has been studied, and the results are given in the present account, which includes details regarding the life history of the fungus.

Treatment of grape mildew, L. RAVAZ (*Min. Agr. [France], Ann. Serv. Épiphyties*, 6 (1918), pp. 281-288).—A study is described which deals with the preparation, application, and effects of fungicides at different strengths. Bordeaux mixture and Burgundy mixture cause scorching, particularly when applied early in May, applications made May 23 causing much less injury and those made July 1 causing none. Injury was roughly proportional to strength up to a 10 per cent concentration.

The banana disease, P. GONZÁLEZ (*Rev. Agr. Puerto Rico*, 3 (1919), No. 5, pp. 51-55, fig. 1).—The banana disease, ascribed to a *Fusarium*, is said to be one of the few severe diseases to which that plant is subject in Porto Rico. The disease may be propagated in planting material. Selection for resistance is considered the most hopeful control measure.

Citrus canker eradication (*Fla. Plant Bd. Bien. Rpt.*, 3 (1919-20), pp. 46-54, 87, 88, figs. 2).—This main report deals more particularly with the last two years of the citrus-canker period to June 30, 1920, general accounts of which have been included in reports previously noted (E. S. R., 44, p. 650).

Work carried on under the direction of F. Stirling in cooperation with the Bureau of Plant Industry, U. S. Department of Agriculture, since April 30, 1919, has progressed satisfactorily, no additional cases of citrus canker appearing in the groves planted in 1913-1915.

A supplemental portion of this report, which is thereby extended through October 31, 1920, states that in July and August infections totaling 539 trees were found, chiefly in a somewhat isolated grove near Boynton, Palm Beach County, which had not been inspected since 1918 on account of shortage of funds. The trees were destroyed, and no further indication of the disease was noted.

Experiments in control of citrus scab (*Fla. Plant Bd. Bien. Rpt.*, 3 (1919-20), p. 42).—A series of experiments was inaugurated in 1916 in an experimental nursery at Gainesville and continued through 1920 to ascertain whether citrus nursery stock practically free from scab can be raised and prepared for market. The results are said to have been entirely satisfactory. Scab has been fully controlled by the use of Bordeaux mixture, also by a certain mixture of Bordeaux and oil emulsion, this mixture also serving as a good insecticide. A very satisfactory type of nursery sprayer has been devised in connection with these experiments.

The behavior of crown gall on the rubber tree, M. LEVINE (*Soc. Expt. Biol. and Med. Proc.*, 17 (1920), No. 7, pp. 157, 158; *abs. in Abs. Bact.*, 4 (1920), No. 6, p. 360).—In continuation of work on crown gall (E. S. R., 43, p. 242), further evidence was obtained regarding the malignancy of crown gall as experimentally induced on mature evergreen perennials such as *Ficus elastica*.

It was found that *Bacterium tumefaciens* inoculated into the apical internode of the branches, the leaves, or the main stem of the rubber tree stimulates the development of a neoplasm in the region of inoculation of a benign or a malignant character. The crown galls so formed in the plant are of two kinds. In one of these growth is uniform and appears to be a swelling. The other is of the characteristic convoluted type, indicating a peripheral growth of isolated nodules. The modes of development of the resulting abnormalities are described as indicating features suggestive of developments in animal cancer.

Control of the white pine blister rust (N. H. State Forestry Comm. *Bien. Rpt.*, 1919-20, pp. 39-52).—An account is given of the local history of white pine blister rust, its distribution in different forms on pine and currant, and control measures, including tabular displays of progress during the period 1917 to 1920, and of the cost of blister-rust control by towns.

The only measure yet found effective is removal of practically all currant bushes for a considerable distance from the pines.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

[**Economic insects, mammals, birds, etc., in Queensland**], H. TRYON (*Queensland Dept. Agr. and Stock, Ann. Rpt.* 1918-19, pp. 37-45).—A report upon the occurrence of important insects and other animal enemies of plants and animals in Queensland.

A manual of the birds of Australia, I, G. M. MATHEWS and T. IREDALE (*London: H. F. & G. Witherby*, 1921, pp. XXIV+279, pls. 46).—This first volume, which is illustrated by colored and monochrome plates by L. Medland, deals with the orders Casuarii to Columbæ, of which 188 forms are described.

Notes on the occurrence of Moniliformis sp. in rats in Texas, A. C. CHANDLER (*Jour. Parasitol.*, 7 (1921), No. 4, pp. 179-183, fig. 1).—In examinations of rats at Houston, Tex., made during the summer of 1920 with a view to determining the possible presence of plague in that city, it was found that the roof rat (*Epimys alexandrinus*) constituted from 35 to 40 per cent of the total number, although in other American cities, including the neighboring cities of Galveston, Beaumont, and New Orleans it constitutes less than 5 per cent of the total rat population. The wharf or Norwegian rat (*E. norvegicus*) constituted 60 per cent of the total number and the black rat (*E. rattus*) less than 1 per cent.

Although Acanthocephala of the genus Moniliformis have been reported in the United States in only three instances, the author found them to be of common occurrence in rats at Houston, approximately 10 per cent of the adult rats being infested, and the percentage in *E. alexandrinus* being higher than in *E. norvegicus*. The number found in a single rat varied from 2 or 3 up to between 100 and 200. Not infrequently the entire small intestine from just behind the stomach to the ileocecal valve was found to be crammed full of the worms and distended to several times its normal diameter.

Field book of insects, F. E. LUTZ (*New York and London: G. P. Putnam's Sons*, 1921, 2. ed., rev. and enl., pp. IX+562, pls. 25, figs. 457).—This is a second revised and enlarged edition of the pocket guide previously noted (E. S. R., 38, p. 761).

Report of the department of entomology, H. T. FERNALD and A. I. BOURNE (*Massachusetts Sta. Rpt. 1920, pp. 36a-43a*).—The progress of work with the onion maggot, codling moth, common scales, etc., briefly reported upon, is followed by an account of studies of spray materials.

Aphicide, a new material manufactured as a substitute for nicotin sprays in controlling plant lice, was tested. The conclusion is drawn that 4 parts of Aphicide and 1 part of soap in 95 parts of water make an effective material for use against aphids and will not, at least under ordinary conditions, injure the foliage.

Sulco V. B., claimed to be a mixture of a fish oil, sulphur, and carbolic acid, proved dangerous to the foliage of the plants, although when used at the strength recommended, namely, 1 to 25 parts of water, it killed the lice. Further tests in which the material was diluted at the rate of 1:60 and even 1:70 gave excellent results with plant lice and no leaf injury.

The value of white arsenic as an insecticide in Bordeaux mixture was tested out in view of recent experiments reported by Sanders and Kelsall in Nova Scotia (*E. S. R.*, 43, p. 850), and since it is much cheaper than either arsenate of lead or arsenate of lime. In order to prepare 50 gal. of the spray, 0.5 lbs. each of white arsenic and fresh, unslaked lime were used. The lime was slaked in just enough water to keep the action brisk, and the arsenic was slowly added during the slaking and thoroughly mixed in. After the slaking had been completed, water sufficient to make 5 gal. was added, and the whole thoroughly stirred. A sack containing 5 lbs. of copper sulphate was then suspended in the mixture and shaken frequently until the copper sulphate had entirely dissolved. About a day later, when ready to spray, 5 lbs. of lime were slaked in a few gallons of water and diluted to make 25 gal. The other mixture, prepared the day before, was also then diluted with water to make 25 gal., and the two lots were poured together, stirred, and sprayed. It is thought probable that when thus prepared the arsenic combines, at least in part, with the copper, forming copper arsenite, which alone is often very injurious to foliage but in this case is rendered noninjurious by the lime present. The suspension of the Bordeaux mixture did not quite equal that of ordinary Bordeaux arsenate of lead, but it adhered to the leaves fully as well, no leaf injury was observed, good protection from potato insects was secured, and no blight appeared on the potatoes. It is pointed out that its use represents a large saving, since 4 lbs. of lead arsenate paste or 2 lbs. of dry lead arsenate are required to furnish an amount of metallic arsenic equal to 0.5 lb. of white arsenic.

Some comparative studies were made of dry sulphids and of lime-sulphur concentrate, for which they are being substituted. Investigations made of the amount of polysulphid sulphur, the active agent, present in lime-sulphur concentrate, in dry lime sulphur, in barium tetrasulphid, and in soluble sulphur (sodium polysulphid) have shown that they contained 25, 49.86, 43.19, and 47.97 per cent, respectively. It appears that the concentrate is the cheapest material by far, and it is also evident that at the strengths advised by their makers the other substances will have much less of the active agent present and should be far less effective than the concentrate. It is suggested that the concentrate used at 1:8 may prove to be stronger than is really necessary.

[**Economic insects in South Dakota**], H. C. SEVERIN (*S. Dak. State Ent. Circs.* 19 (1920), pp. 4, fig. 1; 20 (1920), pp. 9, fig. 1; 21 (1921), pp. 10, figs. 2; 22 (1921), pp. 4, fig. 1; 23 (1921), pp. 10, figs. 4; 24 (1921), pp. 10, figs. 4).—These circulars deal respectively with the black horned tree cricket (*Oecanthus nigricornis* Wlk.); house ants, of which there are four species, namely, the tiny thief ant (*Solenopsis molesta* Say), little black ant (*Monomorium mini-*

mun Buck.), little red house ant (*M. pharaonis* L.), and little brown field ant (*Lasius niger americanus* Em. and *L. niger neoniger* Em.); clothes moths; the large willow sawfly (*Cimbea americana* Leach); the tent caterpillar and the fall webworm; and the army worm.

Proceedings of the Entomological Society of Nova Scotia for 1920 (*Ent. Soc. Nova Scotia, Proc.*, No. 6 (1920), pp. 89, pls. 2).—The papers here presented are as follows: Our Arsenic Supply, by G. E. Sanders (pp. 8-11); The Biology and Stages of *Gypona octolineata* Say, by W. H. Brittain (pp. 12-22); The European Corn Borer in Canada, by W. N. Keenan (pp. 23-31); Points of Interest Noted from 1920 Experiments, by V. D. Durling (pp. 32-35); Entomogenous Fungi, by A. G. Dustan (pp. 36-45); Some Notes on *Apanteles hyphantria* Riley, by R. P. Gorham (pp. 46-50); Results of the Spruce Budworm Survey in New Brunswick, by J. D. Tothill (pp. 51-53); Experiments in the Control of the Cabbage Maggot (*Chortophila brassicae* Bouché) in 1920, by W. H. Brittain (pp. 54-73); The Brown-tail Moth Situation in Nova Scotia, by F. C. Gilliatt (pp. 74-80); and Some Notes on the Habits of *Campoplex pilosulus*, a Primary Parasite of the Fall Webworm, by A. G. Dustan (pp. 81-88).

[Contributions on economic insects] (*Ztschr. Angew. Ent.*, 5 (1919), No. 1-2, pp. V+337, figs. 104).—The papers presented in the first part of this volume are as follows: The Present Status of Investigations of May Beetles, by F. Zweigelt (pp. 3-33); The May-beetle Pest and Bird Protection, by K. Haenel (pp. 34-42); Observations on the Outbreak of the Larvæ of *Agrotis segetum* Schiff. in 1917, by H. C. Müller and E. Molz (pp. 43-46); Information on *A. segetum*, by W. Herold (pp. 47-60); The Source of the Mosquito Plague, by H. Prell (pp. 61-66); The Life History and Development of *Otiiorhynchus rotundatus* Sieb., by H. von Lengerken (pp. 67-84); A Decade of the Royal Institution for Apiculture (pp. 84-87) and The Influence of Hybridization on Honey Production, both by E. Zander (pp. 88-92); Methods of Entomological Investigation, by J. S. Szymanski (pp. 93-97); Investigations of Some Insect Enemies of Forests in Sweden, by I. Trägårdh (pp. 98-104); etc.

The second part includes the following papers: Insect Enemies of the Family Entomophthoraceae: Contribution to a Monograph of Insect-destroying Fungi, with a bibliography of 216 titles (pp. 161-216); A Solution of the Phylloxera Question Through Reform in Grape Culture, by M. Popoff (pp. 217-225); *Plocaederus obesus* Gah., an Enemy of Kapok Trees (*Eriodendron anfractuosum*), by K. Friederichs (pp. 226-230); The Pupal Cell of the Honeybee, by L. Arnhart (pp. 231-251); A New Group of Beetles of Central Europe (*Paederus*, Staphylinidae), by F. Netolitzky (pp. 252-257); An Extensive Outbreak of Meat Flies (*Calliphora vomitoria* L.), by A. Hase (pp. 258-260); The Biology of the Small Housefly (*Fannia canicularis* L.), by J. Wilhelmi (pp. 261-266); *Homocidoma nebuella* Hb. as a Sunflower Pest in Rumania, by L. Reh (pp. 267-277); Which Silphid Adults Eat Rape Leaves? etc., by R. Kleine (pp. 278-285); Observations on the Overwintering of *Empusa muscae*, by G. Lakon (pp. 286-290); The Economic Importance of Ichneumonidae, by S. van Burgst (pp. 291-294); On the Distribution and Life History of *Otiiorhynchus rotundatus* Sieb., by F. Burkhardt (pp. 295-300); etc.

Higher reaches in insect control, P. J. PARROTT (*N. Y. State Hort. Soc. Proc.*, 2 (1920), pp. 26-35, pls. 2).—This is a paper presented at the second annual meeting of the New York State Horticultural Society, held at Rochester, N. Y., in January, 1920. The subjects treated include benefits from the delayed dormant treatment, pointers on safe and efficient spraying, recent experiences with new insecticides, insecticidal properties of lime and clay, the work of curculios in fruit plantings, the apple leafhopper and potato tipburn, and control of the cabbage aphids.

[**Insect control work**], C. W. HAUCK (*Yakima County, Wash., Dist. Hort. Insp. Ann. Rpts. 1918-19, pp. 41-45*).—It is evident from experimental work with the codling moth at Selah, Wash., that banding the trees will not take the place of sprays, even when extreme care is taken to destroy all larvae finding their way into the bands, because it is impossible to eliminate all other places in which the larvae may pupate. In a comparison made of calcium arsenate and magnesium arsenate with arsenate of lead, there was a small percentage in favor of the calcium and a little larger percentage in favor of the magnesium.

Experiments with Jonson's Eureka Spray, a commercial product recommended as a combination spray for the control of scale, worms, and aphids which could be applied during the growing season, show it to be quite effective against woolly and other aphids, although not more so than Blackleaf 40 and distillate oil emulsion. "It is fairly efficient in its control of the codling moth, as the tract under consideration showed comparatively little infestation with worms during the early part of the season. Later, after the cessation of spraying, wormy fruit became more plentiful, and at harvest time it was noted that the great majority of injuries due to the larvae were late ones. Fruit from the check trees showed both early and late injuries." It "has some killing qualities when directed against scale, although scarcely a marketable apple was produced in this orchard. Apparently the spray reduced the scale by 12 to 15 per cent. This is not a large enough gain, however, to justify reliance on this material as the only instrument to be used against this pest. Far better results should be obtained in cases of severe infestation by the use of lime sulphur as a dormant spray."

Dusting v. spraying for insect control, T. J. HEADLEE (*Peninsula Hort. Soc. [Del.] Trans., 34 (1921), pp. 51-60, fig. 1*).—The data here presented are based upon the work noted from another source (*E. S. R., 45, p. 254*).

Liquid gas, Cyanofumer, or pots—which shall it be? R. S. WOGLUM (*Calif. Citrogr., 6 (1921), No. 10, pp. 350, 351*).—This is a summary of the fumigation situation in California.

Pests and diseases of barley and malt.—I, Injurious insects, F. A. MASON (*Jour. Inst. Brewing, 27 (1921), No. 7, pp. 346-379*).—This paper deals with field pests and with the pests of stored barley and malt.

Some orchard pests of the past season: An entomological report, G. W. HERRICK (*N. Y. State Hort. Soc. Proc., 2 (1920), pp. 16-25, pls. 2*).—This is a paper delivered at the second annual meeting of the New York State Horticultural Society, held at Rochester, N. Y., in January, 1920.

[**Cranberry insects**], H. J. FRANKLIN (*Massachusetts Sta. Rpt. 1920, pp. 32a, 33a*).—During the year hitherto unknown parasites of the cranberry girdler (*Crambus hortuellus*) were reared. A new means of control worked out for it consists in spraying with nicotin sulphate to kill the adults. The application of this insecticide also destroyed leafhoppers and springtails, which usually infest in great numbers the vines of bogs that are not reflowed and probably reduce their vitality considerably. The brown spanworm (*Epelis truncataria faxonii*) was unusually prevalent, the moths occurring in great numbers on even more bogs than in 1919. The green spanworm (*Cymatophora sulphurea*) was also unusually prevalent.

Fig insect investigations, D. T. FULLAWAY (*Hawaii. Forester and Agr., 18 (1921), No. 6, pp. 139-143*).—The author reports upon a trip to China, the Malay Peninsula, and India to investigate in their respective ranges and determine the most useful and desirable species of *Ficus* to propagate in Hawaii, the agent or agents of fertilization, the degree of strictness in the relationship between insect and plant, and the best method of transporting the insects.

[The insect enemies of the coconut palm], H. MORSTATT (*Arb. Biol. Reichsanst. Land u. Forstw.*, 10 (1920), No. 3, pp. 195-242, figs. 15).—This is a summary of information on the more important insect enemies of the coconut palm.

Poison the grasshoppers, C. L. FLUKE, JR. (*Wis. Agr. Col. Ext. Circ.* 135 (1921), pp. 4).—This is a brief summary of information, giving a formula and directions for using poison bait against grasshoppers.

Biology and control measures for the German cockroach (*Phyllodromia germanica* L.), J. WILLE (*Monog. Angew. Ent.* No. 5, (1920), pp. IV+140, pls. 2, figs. 53).—This is an extended report of biological studies of *P. germanica* and means for its control, with a bibliography of 86 titles.

The chinch bug in Indiana, J. J. DAVIS (*Purdue Univ. Agr. Ext. Bul.* 99 (1921), pp. 8, figs. 4).—This is a popular summary of information.

Biological control of the black scale in California, H. S. SMITH (*Calif. Dept. Agr. Mo. Bul.*, 10 (1921), No. 4, pp. 127-137, pl. 1, figs. 4).—The author reports upon the introduction into and establishment in California of one of two important parasitic enemies of the black scale occurring in South Africa, namely, *Aphyus lounsburyi*. With the introduction of this parasite the sequence of natural enemies of this scale in California was completed. In the fall of 1919 the propagation of natural enemies of this scale was started under general supervision of the State Department of Agriculture, two stations being established, one on the Limoneira ranch at Santa Paula and the other under interior conditions at Alhambra.

It is pointed out that there are two distinct types in the development of the black scale in southern California known as the "uneven hatch" and the "even hatch," the method of handling the parasites having to correspond with the seasonal history of the scale.

A monograph on Italian Coccidae, G. LEONARDI, edited by F. SILVESTRI (*Monografia delle Cocciniglie Italiane. Portici: Ernesto Della Torre, 1920, pp. VII+555, figs. 375; abs. in Rev. Appl. Ent.*, 9 (1921), Ser. A, No. 6, p. 302).—This important monograph of the Coccidae of Italy was completed, just prior to the author's death, from material collected during the work of a lifetime on the Coccidae.

The Douglas fir aphid (*Chermes cooleyi* Gill.), N. CUNLIFFE (*Quart. Jour. Forestry*, 15 (1921), No. 3, pp. 157-159).—The author reports that this coccid has been introduced into England from North America during the past few years, probably on imported trees, having been noted about 1907 at East Liss, in Hampshire. Since that time it has been observed in many localities in England and Scotland, most probably having been distributed with nursery plants. It has not, as far as is known at present, spread into Wales and Ireland.

On the physiology of the silkworm, A. P. JAMESON and W. R. G. ATKINS (*Biochem. Jour.*, 15 (1921), No. 2, pp. 209-212).—The work by S. Sawamura and others on the digestive enzymes of the silkworm is reviewed, and tests made for some of these enzymes are reported upon.

The glasshouse tomato moth and its control, L. LLOYD (*Expt. and Research Sta., Cheshunt, Herts., Ann. Rpt.*, 5 (1919), pp. I-VIII).—This is an account of *Hadena oleracea* and means for its control. An earlier account has been noted (*E. S. R.*, 44, p. 456).

Injury to tobacco by caterpillars in the curing shed and their control, E. MJÖBERG (*Meded. Deli Proefsta. Medan, 2. ser.*, No. 17 (1921), pp. 29, pls. 6, figs. 3).—Included in this report is an account of investigations of lepidopterous larvæ of the genera *Prodenia*, *Plusia*, and *Heliothis*, which attack tobacco in

Sumatra, and of the use of hydrocyanic acid gas as a means of control in the drying shed.

Experiments and suggestions for the control of the codling moth in the Grand Valley of Colorado, E. H. SIEGLER and H. K. PLANK (*U. S. Dept. Agr. Bul. 959 (1921), pp. 38, pls. 2*).—This is a report of control work conducted during the years 1915 and 1916, in connection with the life-history studies previously noted (*E. S. R.*, 45, p. 855), and continued during 1917 and 1918, in cooperation with the Colorado Experiment Station. Much of the data are presented in tabular form.

The Grand Valley is located in the western part of Mesa County and extends from Palisades to Fruita, a distance of about 32 miles. It is one of the most important fruit-growing regions of Colorado, having approximately 15,000 acres devoted to fruits, of which about 10,000 acres is planted to apples and 2,500 to pears, both of which are heavily attacked by the codling moth.

The work indicates that the codling moth presents a very difficult problem in Grand Valley, where there are two full broods of larvæ each year and a partial third. The moth is extremely prolific because of the warm dry climate, and as a result the apples are exposed to large numbers of the newly hatching larvæ practically every day during the development of the fruit. Life-history studies have shown that the development of the codling moth from the time of hatching of the first eggs of the season does not as a rule vary to any great extent, and that an average can be struck which, over a series of years, would usually represent the approximate development of the insect with sufficient accuracy for spraying purposes. Complete and accurate data on the approximate time of hatching of each brood of larvæ and the relative number of worms that are developing from time to time were obtained in the life-history studies, and with these data at hand it is believed that the most effective time for making the spray applications can be established.

Three sets of schedules, all starting from the time 90 per cent of the petals have dropped, are presented in tabular form, by reference to which it is seen that schedule 1 calls for five applications and is intended for orchards having a relatively light infestation and for varieties on which the codling moth is not difficult to control; schedule 2 calls for six applications for a medium infestation and for varieties on which the codling moth is moderately difficult to control; and schedule 3 calls for seven applications for heavy infestations, for varieties on which the codling moth is most difficult to control. The codling moth is normally abundant in the Grand Valley, and on apples such as the Ben Davis, Schackelford, and other susceptible varieties will usually require schedule 3, or seven treatments, whereas under similar conditions of infestation varieties like the Winesap, on which the codling moth is more readily controlled, will require a smaller number of applications, as in schedules 1 or 2. It is pointed out that the fruit grower should pay particular attention to spraying first-brood larvæ and make every effort to poison as many of these as possible, otherwise he will have small chance of success against the later broods.

Arsenate of lead at the rate of 1 lb. of the powder or 2 lbs. of paste to 50 gal. of water is recommended as the most satisfactory poison. For convenience in handling and storing the powdered product is preferable to the paste. To spray the orchard as quickly as possible during the critical period it is recommended that a power sprayer of ample capacity and capable of supplying three leads of hose with a pressure of 225 to 250 lbs. be used. Banding is recommended as a supplementary control measure, examinations to be made every 10 days from the middle of June to August 31, and a final examination

any time after the fruit is harvested. The banding method if properly worked from year to year in conjunction with thorough spraying will gradually reduce the number of individuals in the orchard so that a larger number of worm-free fruit will be obtained than with spraying alone. A codling-moth trap which will serve the same purpose as banding, and which has been devised as a substitute, is described.

Codling moth control for certain sections of Colorado, G. M. LIST and J. H. NEWTON (*Colorado Sta. Bul.* 268 (1921), pp. 31, figs. 12).—This report is based upon data largely collected at Paonia, Delta County, where conditions are fairly typical of a number of sections of Colorado. Thus the recommendations presented can be interpreted to apply to most of the fruit-growing sections of the State with the exception of the Grand Valley, Mesa County, where the conditions are entirely different and the pest much more difficult to control.

The authors have found that at Paonia there is one complete generation and that from 20 to 40 per cent of the individuals pass through a second. The investigations have been summarized as follows: "The development and activities of all stages of the insect are closely correlated with the temperature. The difference between the time of appearance of a certain stage of the insect in 1917 and 1919 was 20 days. The average time for the development from egg to egg at Paonia was, in 1918, 61.29 days; in 1919, 48.11 days; and in 1920, 54.89 days.

"Spray dates to be accurate must be based upon seasonal life-history studies. Spraying with arsenate of lead is the most effective means of control. Lack of thoroughness in spraying is a very important factor in poor results obtained by many. The use of bands and the picking and destroying of wormy apples are valuable means of control.

"Under certain conditions, 3, 4, and 5-spray schedules are recommended. Occasionally a sixth application may be profitable. The calyx application is considered essential. The fruit grower can establish spray dates fairly accurately by making certain simple studies of the insect. Unsprayed trees showed 12.14 per cent more wormy apples above 12 ft. than below. Where the 4-spray schedule was used as a calyx application with one cover spray on first brood and two on second, better results were obtained than where used as calyx application with two cover sprays on first brood and one on second. Five-spray schedule gave better results than either of the 4-spray schedules.

"The results from the use of a soap as a spreader did not justify the expense. Less efficiency in controlling the worms was obtained in parts of the tree above 12 ft. than in the lower parts. The codling moth can be controlled with less difficulty on the Winesap apple than on Ben Davis and Rome Beauty. The wormy fruit on one block of the Winesap was reduced to 0.12 per cent.

"In a well-sprayed orchard the greatest commercial loss is caused by 'stings.' Very few stings are found on unsprayed fruit. A large percentage of the stings are caused by the small larvæ eating enough of the fruit to make a bluish before they are killed by the poison.

"Trees in any orchard may vary a great deal in codling-moth infestation. A limited number of 'count' trees may not show the true codling-moth infestation. A comparison of wormy or free apples may not be an accurate basis for judging the value of a spray schedule or practice. A comparison of the live larvæ on a tree or block with the number of larvæ killed, as indicated by the stings on the same tree or block, may be a fair way of rating the value of the spraying practice."

Some developments in the spruce budworm situation in New Brunswick, J. D. TOTHILL (*New Brunswick Crown Land Dept. Ann. Rpt.*, 59 (1919), pp. 161-165).—The author reports that the injury done by the spruce budworm in 1919 was widespread and serious, reports of injury having been received from practically every forest district south of the main valley of the Restigouche River. With the balsam fir, only trees of merchantable size have, as a rule, been attacked. Although the spruce budworm had been on the rampage in New Brunswick for six years, prior to 1919 only slight damage had been done to the spruce. During 1919, however, spruce was severely injured, at least in the lower half of Northumberland County and possibly at other places.

The spruce budworm survey, J. TOTHILL (*New Brunswick Crown Land Dept. Ann. Rpt.*, 60 (1920), pp. 85, 86).—The author reports briefly on a survey made during the year with the view to determining in a general way how the Province has been affected by the spruce budworm. The outbreak is said to be past and fully 90 per cent of the spruce is recovering.

Pink bollworm in the West Indies, H. A. BALLOU (*Agr. News [Barbados]*, 20 (1921), No. 500, p. 202).—The recent discovery of the pink bollworm in Anquilla, Antigua, and Virgin Gorda, in addition to Montserrat, St. Kitts, and Nevis, where it has been known for some months, is reported, it having now become distributed throughout the Leeward and British Virgin Islands.

A skin-feeding tortricid (*Cacoecia franciscana* Wals.) injurious to apples in the Pajaro Valley, D. D. PENNY (*Calif. Dept. Agr. Mo. Bul.*, 10 (1921), No. 4, pp. 146-150, figs. 3).—For several years past, apples at picking time and while held in storage during the winter in the Watsonville District have been subject to the work of the small tortricid moth *C. franciscana*. It is said to have been observed as early as 1914 in packing houses. In feeding, the larvæ peel the skin of the apple, involving but little of the pulp. The area affected may be small or extensive, usually well defined and with a clear-cut, sculptured appearance, particularly on fruit injured at an advanced stage of development, beyond which healing will not take place. In the Pajaro Valley the pest is commonly known as the "skinworm," from the nature of its injury.

"One of the characteristic habits of the larva is that of webbing itself into protected places, such as folded leaves or leaves webbed to twigs or fruit, from which it crawls out to feed in the immediate vicinity, returning at intervals or when disturbed. The stem and blossom ends of the apple offer a very desirable protection and a great many of the apples are affected at these parts. Loose apples in boxes, however, are commonly side-injured, which is the result of the larva feeding from the shelter afforded by the contact of two or more apples." It is pointed out that this injury to the fruit is somewhat incidental, being probably due to the selection of the apple by the larva as a place of protection rather than to its desire to utilize it for food.

Life history studies show that there is an irregular brood of worms appearing in late summer and fall, the individuals of which continue throughout the winter either as full-grown or partially-grown larvæ. These overwintering larvæ, with the exception of the ones removed with the fruit during the harvest, remain on the trees in any sheltered hiding place that is convenient, many of them having been found on the inside of old tussock moth pupa cases and under dried leaves which are held to the twigs. The overwintering larvæ, particularly the immature ones, are active and continue to feed to some extent on the very small twigs and buds, pupation and emergence taking place in early spring. The evidence obtained points to the occurrence of a more or less even spring brood of worms, which it is thought will present the best conditions for the application of control measures.

Two other lepidopterous species closely associated with *C. franciscana* in the Watsonville apple district have been determined as *Pandemis pyrusana* Kearf. and *Peronea* sp. The habits and appearance of the larvæ of these species at first leads to some confusion with the larvæ of *C. franciscana*, but the moths are distinctly different.

Studies of *Zenillia roseanæ* B. and B., a parasite of the European corn borer, W. R. and M. C. THOMPSON (*Ent. Soc. Wash. Proc.*, 23 (1921), No. 6, pp. 127-139, figs. 20).—This is a report of the principal technical results obtained during the first year of work in southern France on one of the European parasites of the European corn borer. The paper contains the technical information necessary for the recognition of the parasite in each of the successive stages of its development and for the elaboration of satisfactory methods of rearing and colonization.

"The most important practical point determined by the investigations undertaken up to the present on the seasonal history of *Zenillia roseanæ* is that this parasite has a seasonal history synchronous with that of the host in southwestern France, having like the latter two generations a year, of which the second is passed in the larval stage in the hibernating caterpillars of the borer."

From the data now available it appears that *Z. roseanæ* is a very important parasite of *Pyrausta nubilalis*.

The crane flies of New York.—II, Biology and phylogeny, C. P. ALEXANDER (*New York Cornell Sta. Mem.* 38 (1920), pp. 691-1133, figs. 540).—This second part of the work previously noted (E. S. R., 42, p. 157) deals with the biology and phylogeny of crane flies, including a bibliography of 24 pages.

Supplementary account of the dipterous larvæ feeding upon mollusks, D. KEILIN (*Parasitology*, 13 (1921), No. 2, pp. 180-183).—This paper supplements that previously noted (E. S. R., 42, p. 454).

The protection of meat commodities against blowflies, R. A. WARDLE (*Ann. Appl. Biol.*, 8 (1921), No. 1, pp. 1-9).—This paper includes a brief report of experiments with repellents.

The cherry fruit fly, A. L. LOVETT (*Oregon Bd. Hort. Bien. Rpt.*, 16 (1919-20), pp. 107-113, figs. 2).—This is a brief summary of information on the cherry fruit fly, numerous reports of serious injury by which to ripe cherries are said to have been received at the Oregon Experiment Station during the past four years. A reprint of the report on The Mally Fruit Fly Remedy (pp. 109-113) follows.

Two new species of Diptera, C. T. GREENE (*Ent. Soc. Wash. Proc.*, 23 (1921), No. 6, pp. 125-127, fig. 1).—*Sturmia sociabilis*, which is related to *S. distincta* Wied., a common parasite of sphinx moths in North America, from Rio Piedras, P. R., and *Phorocera meracanthæ*, reared from the larva of *Meracantha contracta* Beary. at Hagerstown, Md., are described as new.

White grub enemies of sugar cane, C. MOREIRA (*Rio de Janeiro: Min. Agr., Indus. e Com.*, 1919, pp. 20, pls. 13).—This is a brief summary of information on white grubs, their habits, and means of combating them in Brazil.

The relation of the Kentucky species of *Solidago* to the period of activity of adult *Cyllene robiniae*, H. GARMAN (*Kentucky Sta. Bul.* 231 (1921), pp. 3-22, figs. 6).—Data relating to the period of emergence of the locust borer as compared with the periods of flowering of 18 species of *Solidago*, based upon collections and observations commenced in 1889, are presented in diagrammatic form. The beetle has been observed in large numbers on *S. altissima* only, and is apparently dependent upon this species, as reported in the account previously noted (E. S. R., 35, p. 355. 552). The fungus *Sporotrichum globuliferum* has been found on the bodies of dead adult locust borers, 10 per cent

at times being infested, but has never been observed on living individuals, and observations indicate that it attacks only enfeebled, spent individuals and is incapable of destroying healthy vigorous adults. A tabular synopsis is given of the Kentucky species of *Solidago*, accompanied by illustrations of the ray flowers (pp. 10-15).

The author presents a few details concerning specimens of *Cyllene* collected and studied with a view to determining whether the locust borer (*C. robinæ*) and the hickory borer (*C. picta*) are one species. The conclusions drawn are that either (1) there are two distinct species, as has long been assumed, one living on hickory and walnut and appearing in the spring of the year as adults, the other living on locust and appearing as an adult in the fall; or (2) there are two forms of one species, one form appearing in spring as adults on locust, hickory, and walnut, the other appearing only on locust in the fall; or (3) there are two forms of the locust borer, one maturing in the fall and the other in the spring, the latter brood differing in no essential feature from the species appearing as adults on hickory in spring. The author is disposed to accept the second explanation.

An enemy of agave introduced from America [*Scyphophorus acupunctatus* Gylh.], S. LEEFMANS (Dept. Landb., Nijv. en Handel [Dutch East Indies], Meded. Inst. Plantenziekten, No. 44 (1920), pp. 6, pls. 2).—This is a brief account of an agave weevil, prepared as a warning to agave planters.

The fern weevil (*Syagrius fulvitaris* Pasc.), D. T. FULLAWAY (Hawaii. Forester and Agr., 18 (1921), No. 5, pp. 101-114, figs. 6).—The account here presented, which includes tabular data, relates to *S. fulvitaris* (E. S. R., 42, p. 549).

Cotton dusting experiments of 1920, D. C. WARREN (Ga. State Bd. Ent. Bul. 59 (1921), pp. 16).—Experiments at the Baxley, Thomasville, and Valdosta Stations are briefly reported.

"In all the experiments conducted comparing dusting in the presence of dew with dusting in its absence, considerably better yields were obtained from dusting while the dew was on the cotton. Also in all tests the plats dusted in the absence of dew yielded better than the checks. The results indicated that dusting while the cotton is wet with dew is more profitable, but in cases of emergency dusting could be done while the cotton is dry rather than allow it to go undusted."

A paper entitled Recommendations for Cotton Dusting for the Coming Season, by I. W. Williams, is appended (p. 15).

First annual report of the division of apiculture to the Governor of Washington, March 1, 1921, A. L. MELANDER (Wash. State Col., Div. Apic. Ann. Rpt., 1 [1920], pp. 119, figs. 32).—This report includes the text of the State apiculture law and numerous papers by various authors relating to bees and beekeeping.

Descriptions of new Philippine wasps of the subfamily Pseninae, S. A. ROHWER (Philippine Jour. Sci., 18 (1921), No. 3, pp. 309-323).

A new species of Habrobracon (Hym., Braconidae), H. L. VIERECK (Ent. News, 32 (1921), No. 6, p. 174).

Notes on certain genera of parasitic Cynipidae proposed by Ashmead, with descriptions of genotypes, L. H. WELD (U. S. Natl. Mus. Proc., 59 (1921), pp. 433-451, figs. 9).

The plum web-spinning sawfly, H. C. SEVERIN (S. Dak. State Ent. Tech. Bul. 1 (1920), pp. 53, figs. 12).—The plum web-spinning sawfly (*Neurotoma inconspicua* Nor.) is said to be the most destructive insect enemy of plum and sand cherry foliage in South Dakota, it causing serious harm to both by devouring the foliage and by spinning webs over the leaves.

There is a single generation of the pest each year, the adults ordinarily appearing during the latter part of May or early June. An average of 46 eggs is deposited by each female in slits on the under surface of the midrib or petiole of the leaf, which hatch after a period of 5 to 7 days. "The larvae are gregarious, and after a destructive feeding period of 13 to 23 days they drop to the ground, enter it to a depth of 1 to 10.5 in., and here hollow out a chamber. The remainder of the summer, fall, winter, and early spring are spent in this cell. With the advent of warm weather in the spring the larvae pupate. The insects spend 7 to 10 days in the pupal stage and then emerge as sawflies.

"A tachinid parasite [*Eubrachymera debilis* Town.] sometimes destroys 50 per cent of the *Neurotoma* larvae, while predacious enemies also kill off many of the insects. In spite of this, it frequently becomes necessary to treat plum trees and sand cherry bushes to keep the foliage from being destroyed. If spraying is resorted to, 1 lb. of lead arsenate in the paste form or 0.5 lb. in the powdered form should be used for each 50 gal. of water, but if dusting is practiced, then 1 lb. of the powdered lead arsenate should be diluted with 15 lbs. of powdered sulphur or air-slaked lime before it is applied to the foliage."

Observations on the eggs of *Dictyocaulus filaria*, H. CRAWLEY (*Jour. Amer. Vet. Med. Assoc.*, 58 (1921), No. 6, pp. 684-688, fig. 1).—The author's studies are summarized as follows:

"The eggs of *D. filaria* average 125 microns long, the extremes of those containing embryos being 135 and 110 microns. They are not symmetrical, the cross section being an ellipse and not a circle. The average of the longer diameter is 77 microns, the extremes being 82 and 72 microns. The average of the shorter diameter is 60 microns, the extremes being 68 and 53 microns. The outline, viewed from one of the flat sides, is fundamentally elliptical, at times somewhat ovoid. Viewed on edge it is elliptical or subcylindrical."

Some notes on the arthropods of medical and veterinary importance in Mesopotamia, and on their relation to disease, III-V, W. S. PATTON (*Indian Jour. Med. Research*, 8 (1920), Nos. 1, pp. 1-16, pls. 2, figs. 2; 2, pp. 245-256, pl. 1).—The third part of this paper, previously noted (*E. S. R.*, 44, p. 760), deals with the bot flies of Mesopotamia, the fourth part with some Mesopotamian Nematocera of economic importance, and the fifth part with some miscellaneous arthropods.

The Montana State Board of Entomology, fourth biennial report, 1919-20, R. A. COOLEY (*Mont. State Bd. Ent. Bien. Rpt.*, 4 (1919-20), pp. 44, fig. 1).—Work during the year with the spotted fever tick (*Dermacentor venustus* Banks), the prevalence of spotted fever in the State, and details relating to the organization and work are reported upon. This is followed by a Report of Tick Control Operations in the Bitter Root Valley during the Seasons of 1919 and 1920, by R. R. Parker (pp. 18-44).

The control of Rocky Mountain spotted fever in the Bitter Root Valley, R. R. PARKER (*Mont. State Bd. Ent. Circ.* 1 (1921), rev., pp. 20).—This is a summary of information on the nature of the disease, the tick and its relation to the disease, means of controlling it, etc.

Paralysis in children due to the bite of wood ticks, P. D. McCORNACK (*Jour. Amer. Med. Assoc.*, 77 (1921), No. 4, pp. 260-263).—"Bites of wood ticks, usually *Dermacentor venustus*, can cause a motor paralysis of the flaccid type. The paralysis is acute, extensive, progressive, and usually ascending in its progress. In man, children are most commonly affected. Death may occur, usually by respiratory paralysis. Recovery is rapid and complete following the complete removal of the tick before respiratory paralysis has occurred. Experimentally, tick bites have produced this type of paralysis."

FOODS—HUMAN NUTRITION.

Home canning, W. W. CHENOWETH (*Mass. Agr. Col. Ext. Leaflet 13 (1921), pp. 31*).—In this extension leaflet on home canning particular attention is called to the fundamental principles involved in the various processes. "The home maker should remember that common sense and good judgment must enter into her canning operations just as into any of her other household practices. Common sense is largely native talent, while good judgment comes partly through experience, partly through adaptability, and largely through a knowledge of the fundamental principles which are the foundation of the science and art of home canning."

Foods and drugs, J. M. BARTLETT (*Maine Sta. Off. Insp. 99 (1921), pp. 20*).—In addition to analysis of drugs, results are reported of the examination under the State pure food law of nonalcoholic beverages, ice cream, unshelled nuts, opened clams, scallops, opened oysters, cider vinegar, corn sirup, molasses kisses, canned tomatoes, and oleo creme ("a phosphate of soda to be used as a substitute for cream of tartar"). Examination showed that this has "about 86 per cent of the acid value of cream of tartar." Analyses are given of four "modified flours" which include gluten and diabetic flours.

Milk and its uses in the home (*U. S. Dept. Agr., Farmers' Bul. 1207 (1921), pp. 34, figs. 5*).—The great importance of milk as food is discussed from the point of view of the consumer, and reasons are given for the conclusion that it is indispensable in the diet of children and one of the best foods for adults. Suggestions for the care and use of milk are also included, as well as directions for pasteurizing it at home. Digestibility of milk, milk for infants, bacteria in milk, milk products, and the use of milk in cooking are subjects which are also given consideration.

The growth-promoting properties of milk and dried milk preparations, J. M. JOHNSON (*Pub. Health Rpts. [U. S.], 36 (1921), No. 34, pp. 2044-2057, figs. 9*).—A comparative study is reported of the growth-promoting properties of ordinary raw milk, raw certified milk, pasteurized milk, and reconstructed milk made from skim milk powder by the addition of water and butter in such proportions as to approximate the composition of standard pasteurized milk with 3.5 per cent butter-fat content. Young white rats weighing from 40 to 60 gm. were fed a basal diet of starch 48, casein purified by washing with dilute acetic acid 25, Osborne and Mendel's salt mixture 5, lard 10, unsalted butter 10, and powdered agar 2 per cent, to which were added measured portions of the milk.

The growth curves obtained showed that with milk as the sole source of water-soluble vitamin it is necessary to furnish at least two and one-half parts of milk to one part of the basal mixture in order to promote normal growth. No difference was noted in the amounts required of the different varieties of milk used, thus indicating that the ordinary processes of pasteurization and of drying by the spray process do not injure the water-soluble vitamin.

It is noted that the proportion of milk required is confirmatory of Osborne and Mendel's conclusion (*E. S. R.*, 43, p. 165) that 16 cc. of fresh milk daily is required by a growing rat. In the tests in which 350 cc. of milk was used for 100 gm. of the basal ration, growth was not as good as with 250 or 300 cc. of milk. In view of the fact that when dry milk corresponding in amount to the solids of the liquid milk was substituted better growth in general took place, the authors are of the opinion that the subnormal growth with this proportion of liquid milk was due to the large amount of liquid in proportion to the solids in such a diet.

Antineuritic vitamin in skim milk powder, J. M. JOHNSON and C. W. HOOPER (*Pub. Health Rpts. [U. S.], 36 (1921), No. 34, pp. 2037-2043, figs. 8*).—Pigeons fed upon mixtures of spray process skim milk powder with polished rice were found to require 30 per cent of the food in the milk powder for full protection from polyneuritis. As this corresponds to about 75 cc. of liquid milk, an amount less than the minimum protective amount for fowls reported by Gibson and Concepcion (*E. S. R.*, 36, p. 665), the authors are of the opinion that the process of drying skim milk does not lead to an appreciable destruction of the antineuritic vitamin.

Fat-soluble vitamin.—VII, The fat-soluble vitamin and yellow pigmentation in animal fats, with some observations on its stability to saponification, H. STEENBOCK, M. T. SELL, and M. V. BUELL (*Jour. Biol. Chem.*, 47 (1921), No. 1, pp. 89-109, figs. 8).—In continuation of the studies on fat-soluble vitamin previously noted (*E. S. R.*, 43, p. 367), data are presented on the fat-soluble vitamin content of various animal fats as correlated with yellow pigmentation, together with a few observations on the stability of this vitamin to saponification. The report of the experimental work is prefaced by a brief description of the criteria used in establishing the lack of vitamin A, including especially the appearance of the eyes of the experimental animals in the various stages of ophthalmitis. The authors are of the opinion that in most instances the infection is most accurately designated as kerato-conjunctivitis rather than a true xerophthalmia. It is also noted that in many animals on a vitamin A-free ration there is an apparent resistance to infection of the eyes, but instead an enophthalmia or small-eyed condition is observed. As these animals often succumb to respiratory infections, it is suggested that such infections probably confer a certain immunity to infection of the eyes.

Fresh cod liver oil practically devoid of yellow pigment furnished an abundance of vitamin A when fed at a level of 0.2 and 0.5 per cent of the entire ration. With butter prepared in March, April, May, and June from cream representative of the composite collection of a large number of dairy farms, a seasonal variation in the fat-soluble vitamin content was noted when the butter was fed at as low a level as 0.5 or 1 per cent of the ration. On increasing the butter fat to 2 per cent, no nutritive differences in the various samples of butter were noted. The pigmentation of the butter as determined by comparison in a Duboscq colorimeter did not run closely parallel to the vitamin content, although the highly pigmented samples were richer in vitamin A than the colorless.

Samples of perinephritic fat of animals of the Jersey, Durham, and Holstein breeds, and beef fat selected promiscuously from slaughtered animals for color intensity, were found to have practically the same relations, those most pigmented being generally the richest in their vitamin A content. The authors are of the opinion that while various factors operate to modify the primary determinative effect of the composition of the ration upon the relations between pigmentation and vitamin A, butter and other fats low in natural yellow pigment should be looked upon with suspicion.

Data are also given showing that vitamin A in animal fats (butter and cod liver oil) resists saponification with alcoholic potash at 37° C. for four hours. This is thought to indicate that the vitamin is not a fat and probably not an ester.

The synthesis of vitamin B by yeasts (preliminary note), A. HARDEN and S. S. ZILVA (*Biochem. Jour.*, 15 (1921), No. 3, pp. 438, 439).—In this preliminary note the authors report slow and imperfect growth of *Saccharomyces cerevisiae* and rapid and luxuriant growth of *S. ellipsoideus* on a synthetic medium containing ammonium phosphate and chlorid as sources of nitrogen, together with

necessary mineral salts and cane sugar, the medium being freed from possible traces of vitamin B by thrice shaking with fuller's earth. The yeasts thus obtained were washed, pressed, and dried and compared with a parallel culture of *S. ellipsoideus* grown on unhopped brewer's yeast as to their curative effect on polyneuritic pigeons. A 1-gm. dose of *S. cerivisiae* brought about temporary cure with recurrence of symptoms after 48 hours, while the same dose of the *S. ellipsoideus* from wort brought about a permanent cure and from the synthetic medium a cure lasting from 4 to 6 days. A 0.5-gm. dose of *S. ellipsoideus* on synthetic medium brought about a temporary cure, but a recurrence of symptoms after 48 hours. The authors conclude that yeasts grown on synthetic media contain vitamin B, but not in so large a proportion as those grown on wort.

Vitamins and certain aspects of their relation to public health, J. C. DRUMMOND (*Amer. Jour. Pub. Health*, 11 (1921), No. 7, pp. 593-597).—The author emphasizes the importance of fresh vegetables, fruit, milk, and eggs as sources of vitamins, and their superior value to proprietary vitamin preparations. "The general attitude of the public toward proprietary vitamin preparations should be a guarded one, since it must be remembered that on every hand may be obtained cheap and natural sources of these indispensable substances."

Similarity of effects produced by absence of vitamins and by exposure to X-rays and radium, W. CRAMER, A. H. DREW, and J. C. MOTTRAM (*Lancet* [London], 1921, I, No. 19, pp. 963, 964).—The authors are of the opinion that the generalization that vitamins are essential for the life of every cell is inaccurate, and that "what has been experimentally established is the fact that vitamins are essential for the maintenance of life of a highly differentiated animal as a whole, but not necessarily or probably of its individual cells." The one form of tissue which is specifically and profoundly affected by the absence of vitamins is shown to be lymphoid tissue, which in rats and mice on a diet free from vitamins undergoes extreme atrophy. In addition to the macroscopic evidences of such changes in the spleen, thymus, Peyer's patches, etc., microscopical examination shows a reduction in the number of leucocytes and lymphocytes in these organs. The blood picture, as shown by a differential count, shows a reduction in the number of lymphocytes and an increase in the number of polymorphonuclear leucocytes. It is pointed out that this condition of the lymphoid tissue is practically identical with that produced by exposure to X-rays and radium, and that there is a further similarity between the effects of X-rays and radium and of a vitamin-free diet in that the experimental animals in both cases lose weight and die in a state of emaciation.

"It is a remarkable fact that the specific atrophy of lymphoid tissue, whether produced by exposure to radiations or resulting from the absence of vitamin from the diet, should be associated with such a profound general effect on the nutrition of the animal. This fact indicates that lymphoid tissue fulfills a more important function in connection with the nutrition of the animal than is generally recognized, and that the effect produced on the general nutritive condition of the animal by these different agencies may be due to their selective action on the lymphoid tissue."

The influence of fasting and of vitamin B deprivation on the nonprotein nitrogen of rat's blood, H. A. MATILL (*Abs. in Science, n. ser.*, 54 (1921), No. 1391, p. 176).—The author reports that while the nonprotein nitrogen of the blood of fasting rats is from 30 to 40 per cent higher than that of normal animals, the most marked increase being in urea, the blood of rats deprived of vitamin B shows practically no variation from the normal except that creatinin

is at the fasting level and creatin is slightly higher than the fasting figure. The desirability of obtaining information on the gaseous metabolism as well as on creatin metabolism in animals deprived of vitamin B is suggested.

Observations on deficiency diseases in Labrador, V. B. APPLETON (*Amer. Jour. Pub. Health*, 11 (1921), No. 7, pp. 617-621).—The observations reported were made during the autumn, winter, and early summer of 1919-20 in Labrador, along the Strait of Belleisle, to determine the exact nature of the diet and the incidence of deficiency diseases among the people of that region. For the purposes of comparison a similar study was made in June, 1920, of a group of communities on the Newfoundland side of the Strait.

On the Labrador side the diet consisted of white flour, salt meat, considerable fresh fish, molasses, a certain amount of fresh vegetables, including potatoes, rutabagas, and cabbage, dried peas and beans, fruit (principally raisins, dried apricots, and dried apples), butter substitute, sweetened condensed milk, and tea. On the Newfoundland side the differences in diet were slight, consisting principally in the absence of canned milk and fresh vegetables, a smaller amount of fresh fish, and butter in place of butter substitutes. The butter was made from milk of cows fed principally on hay, the milk being scalded sometimes for an hour and a half to facilitate the separation of cream for butter making.

On the Labrador side deficiency diseases, including xerophthalmia, scurvy, pellagra, beriberi, and rickets occurred only as isolated cases, while on the Newfoundland side beriberi and xerophthalmia were very prevalent and the infant mortality was much higher. The author is of the opinion that there is but little margin of safety with regard to deficiency diseases in both regions, but that the inhabitants of the Labrador side were protected except in isolated cases by the vitamins furnished by the canned milk and vegetables and by the additional protein supplied by a longer season of fresh fish. It is of significance that the condensed milk was evidently a more satisfactory source of vitamins than the butter made from the milk of cows fed on poor hay deficient in vitamins.

The question of night blindness as a deficiency disease is considered at some length. In view of the fact that it did not occur in the region in which beriberi and xerophthalmia were common but in places where these diseases were absent, and that it occurred in greatest frequency during the period of greatest glare from the snow, the author suggests that it is not a deficiency disease but is most likely a prolonged negative after-image resulting from long-continued exposure to the glare of the snow. Other points noted are the absence of rickets, suggesting the importance of chronic infection as a predisposing factor in the etiology of the disease, and the increased susceptibility to tuberculosis in the absence of protective substances in the food.

Nutritional keratomalacia in infants, S. G. ROSS (*Amer. Jour. Diseases Children*, 22 (1921), No. 3, pp. 232-243).—The reports are presented and discussed of cases of nutritional keratomalacia in four infants who had been fed almost exclusively on sweetened condensed milk. Three of the four patients died, two having broncho-pneumonia in addition to the keratomalacia. It is of interest that in the other fatal case the eye lesions had healed before death. In this and the case which recovered cod-liver oil had been administered in connection with careful feeding of protein milk followed by breast milk and cow's milk.

The author states in conclusion that "clinically and histologically the keratomalacia is very similar to the eye lesions produced experimentally in rats by a diet lacking in the fat-soluble A factor. The weight of evidence would

tend to show that the cases occurring in human beings have also resulted from a lack of the same factor. If so, this 'nutritional keratomalacia' in infants is the manifestation of a definite 'deficiency disease' in the sense in which we now understand the term."

The relation of the fat-soluble factor to rickets and growth in pigs, S. S. ZILVA, J. GOLDING, J. C. DRUMMOND, and K. H. COWARD (*Biochem. Jour.*, 15 (1921), No. 3, pp. 427-437, pl. 1, figs. 3).—Evidence that lack of vitamin A is not the sole determining factor in the development of rickets is furnished by the reported inability to induce definite rickets in two pigs fed from birth on a diet vigorously restricted in the fat-soluble vitamin. While the requirements of the pig for vitamin A are of a low order, as previously pointed out (E. S. R., 45, p. 566) and as shown in the present study by the comparatively small quantity of cream and crude caseinogen sufficient to act as a source of vitamin A for one of the animals during about five months, evidence is furnished that vitamin A does promote growth in pigs, as shown by the resumption of growth on the addition of more cream to the restricted diet. This was further confirmed by an extension of the study described in the previous paper. Some of the pigs which had ceased growing on diets of toppings and synthetic whey and toppings and ordinary whey were later given vitamin A in the form of crude cod-liver oil and of fresh alfalfa. Growth was immediately resumed in both cases.

Pellagra, W. J. MACNEAL (*Amer. Jour. Med. Sci.*, 161 (1921), No. 4, pp. 469-501, figs. 13).—This is a general discussion of the etiology, clinical manifestations, and treatment of pellagra.

In the opinion of the author the etiology of the disease depends upon two factors: "(1) The specific causative factor which is a living organism, an infectious agent derived directly or indirectly from a previous case of the disease, and (2) a factor or group of factors, quite nonspecific, which serve to reduce the resistance of the victim. In this latter group are recognized malnutrition, either from inadequate food or inability to utilize food in an adequate manner, cachexia of disease, overwork, depressing influence of hot weather, strain of reproduction in women, involution of old age, alcoholism, and many other such influences."

The effects of an unbalanced diet in the production of guinea-pig scurvy, G. M. FINDLAY (*Biochem. Jour.*, 15 (1921), No. 3, pp. 355-357).—The possible effect of excess carbohydrate, fat, or protein on the onset and symptoms of scurvy in guinea pigs was studied in four groups of six animals each, one group receiving a basal scurvy-producing diet of oats and bran ad libitum with 60 cc. of autoclaved milk per day, and the other three groups the same diet with the addition of 10 gm. of caseinogen, 10 gm. of sugar, and 10 gm. of cod-liver oil, respectively.

The date at which the first symptoms of scurvy appeared was not affected by the above additions to the basal diet. The date of death was, however, slightly accelerated by excess of either protein or carbohydrate, while the loss in weight was greatly increased in the guinea pigs suffering from scurvy when the diet contained an excess of carbohydrate.

Anesthesia in the treatment of botulism, J. BRONFENBRENNER and H. WEISS (*Jour. Amer. Med. Assoc.*, 76 (1921), No. 25, pp. 1741, 1742).—In the course of investigations designed to establish the path of absorption of botulinus toxin in guinea pigs, it was accidentally found that in animals kept under ether death following the introduction of large amounts of toxin was greatly delayed. The suggestion, substantiated by guinea-pig experiments, is made of taking advantage of the delay in the rate of the progress of botulinus intoxication under ether anesthesia to permit toxin-antitoxin combination to take place.

Creatinuria, II, III, E. G. GROSS and H. STEENBOCK (*Jour. Biol. Chem.*, 47 (1921), No. 1, pp. 33-52).—In continuation of the investigation of creatinuria previously noted (E. S. R., 40, p. 365) two papers are presented.

II. *Arginin and cystin as precursors of creatin* (pp. 33-43).—In the search for possible precursors of creatin, arginin and cystin were examined as to their effect on creatin excretion in the pig, using the experimental procedure of the earlier study. The effect of arginin was also compared with the effect of casein of equal arginin content.

It was found that arginin administered orally in sufficient amounts augmented creatin excretion, but not to the same degree as an equivalent amount of casein. In explanation of this difference it is suggested that acids such as phosphoric acid, which is liberated in the metabolism of casein, stimulate the production of creatinuria, that the casein molecule may contain other precursors of creatin, and finally that free arginin may be metabolized to urea faster than the arginin as absorbed with the products of digestion. The first of these suggestions is considered the most plausible.

Cystin feeding resulted in creatinuria only when the sulphuric acid formed by the oxidation of its sulphur was left unneutralized, although neutralization of acidity did not prevent the creatinuria resulting from casein or arginin feeding. This is thought to furnish sufficient evidence that cystin creatinuria owes its origin to other factors than those operative when casein is fed.

III. *The effect of thyroid feeding upon creatinuric* (pp. 45-52).—In an attempt to explain the apparent inconsistency involved in attributing creatin formation to certain processes of protein metabolism while admitting the marked difference existing in men and women regarding creatin formation, the authors suggest that in the thyroid mechanism is to be sought the variable responsible for the difference in reaction of men and women to protein feeding. To substantiate this theory pigs on a nitrogen-free diet were fed sheep's thyroid with resulting marked stimulation of creatin formation, further accentuated by the feeding of casein as an exogenous source of creatin precursor. "It is suggested that creatin formation is primarily dependent upon the balance that obtains between the arginase and oxidative systems, whereby arginin is destroyed. On these premises arginin from exogenous sources is not metabolized into creatin in the same proportions as arginin from endogenous sources, because this balance varies in different organs. Furthermore, it is suggested that the thyroid principle may be active in causing creatin formation by accelerating the oxidative system of arginin destruction at the expense of the effect of arginase."

The evil effect of excess of protein on milk secretion, G. A. HARTWELL (*Lancet [London]*, 1921, I, No. 24, p. 1240, fig. 1).—This is a brief report of an extension of the investigation previously noted (E. S. R., 45, p. 863) to include the effect of excess of various proteins other than caseinogen upon mammary secretion in the rat as determined by the growth and well-being of the young.

Excess protein in the form of egg and blood albumin, gelatin, gluten, dried fish, and dried meat protein produced the same effect as that noted with caseinogen. The young grew at normal rate for about 10 days, then ceased to grow, and died in from 15 to 20 days. For a few days before the change in the rate of growth appeared the young showed great excitability, later developing into spasms. On autopsy the stomach and intestines appeared to be almost empty.

It is suggested that this condition, with fatal outcome, is due to failure of the milk secretion, preceded by some change in composition which is responsible

for the spasms. "It is unlikely that nursing women ever take a dietary containing nearly as much protein as carbohydrate and practically no fat. But if we may argue from rats to human beings, it is clear that excessive proportions of protein in the mother's diet may lead to metabolic and nervous trouble in the suckling."

ANIMAL PRODUCTION.

Studies in animal nutrition.—I, Changes in form and weight on different planes of nutrition, C. R. MOULTON, P. F. TROWBRIDGE, and L. D. HAIGH (*Missouri Sta. Research Bul. 43 (1921), pp. 3-111, pl. 1, figs. 30*).—The authors present and discuss a large amount of data on the body weights, body measurements, and feed consumption at 30-day intervals throughout life of 59 steers, mainly of Hereford and Shorthorn breeding. All but 3 of the steers were divided into three groups, according to the plane of nutrition. Group 1 steers were given a full feed, group 2 were fed for maximum growth without appreciable storage of fat, and group 3 were fed for only moderate growth, i. e., to gain about a half a pound a day between the ages of 18 months and 3 years. Corn chop, whole oats, and linseed meal (6:3:1) formed the grain mixture. Alfalfa hay was given in amounts equal to half the grain consumption, and when young the calves received milk standardized to a definite fat content. The differences in growth were obtained by altering the amounts and not the proportions of the feed. The differences between the three groups in weight, gain, and economy of gain at intervals of approximately a year are summarized in the following table:

Results of feeding 3 groups of steers on (1) full, (2) moderate, and (3) scanty rations.

Age period (days).	Average initial weights of steer.			Daily gains per steer.			Dry matter consumed per pound of gain.		
	Group 1.	Group 2.	Group 3.	Group 1.	Group 2.	Group 3.	Group 1.	Group 2.	Group 3.
	Pounds.	Pounds.	Pounds.	Pounds.	Pounds.	Pounds.	Pounds.	Pounds.	Pounds.
30-360.....	139	127	133	1.83	1.24	0.73	5.08	4.71	5.24
361-720.....	744	536	377	1.56	.89	.65	11.26	11.28	10.27
721-1,080.....	1,305	857	613	1.09	.35	.34	17.02	28.60	23.20
1,081-1,440.....	1,696	984	734	.75	.75	.86	23.45	15.74	11.45
30-1,440.....	¹ 1,965	¹ 1,255	¹ 1,045	1.30	.80	.65	12.24	11.91	11.03

¹ Weight at 1,440 days.

There was little difference between the three groups in height at withers or in height at hips at any time throughout life. In length of body, width at hips, and particularly heart girth, group 1 exceeded group 2 and group 2 exceeded group 3. Outlines of the girth at the heart, paunch, and flank, made as described in Research Bulletin 30 (E. S. R., 42, p. 65), showed that groups 2 and 3 were much more narrow in the chest and flank than the group 1 steers and had a distinct tendency to develop a ridge along the mid-dorsal line. The breaking strength of the shin bone and the cannon bone, which was determined for 25 of the animals after slaughter, seemed not to be affected by the plane of nutrition except indirectly by the influence of the feed on the live weight of the animal. Where the results were not complicated by excessive fatness, the breaking load was found to be proportional to the four-fifths power of the body weight.

The three steers not assigned to a group were kept at maintenance for about a year. They failed to regain normal body dimensions after three years of adequate feeding.

The utilization of molasses amids in comparison with protein by the organism of ruminants, W. VÖLTZ, W. DIETRICH, and A. DEUTSCHLAND (*Landw. Jahrb.*, 52 (1918), No. 3, pp. 431-455).—Continuing the earlier work of Völtz (*E. S. R.*, 19, p. 1167), the authors report digestion and nitrogen balance trials with a wether fed beet molasses and oat straw during one period and casein and oat straw during a second period. During the feeding of molasses, which is high in amid nitrogen, about 77 per cent of the amids were digested and more true protein nitrogen appeared in the feces than was taken in the food. The casein experiment was somewhat unsatisfactory, since only about 25 per cent of the protein was digested. That this was not due to deficiencies in the casein preparation used was shown by experiments with a bitch which digested 96.9 per cent of the protein in the casein.

In a balance experiment with another wether during which beet vinasse and meadow hay were fed, the nitrogen balances were systematically negative, although a high proportion of the crude protein was digested. No evidence was found that the amid nitrogen of the beet vinasse was utilized. It is suggested that the presence of sugar is necessary to permit the synthesis of amid nitrogen into more complex products. The authors are inclined to believe that the synthesis is brought about by microorganisms present in the digestive tract.

The replacement of feed protein by urea for growing ruminants; the feeding value of straw and chaff hydrolyzed by the Beckmann process, W. VÖLTZ (*Biochem. Ztschr.*, 102 (1920), pp. 151-227).—The author reports experiments with three lambs and one growing wether involving 13 digestion and nitrogen-balance trials. In 11 trials urea formed the principal source of nitrogen, the only other source aside from traces in the carbohydrates fed being rye straw or rye chaff hydrolyzed by the Beckmann process (digestion in dilute sodium hydroxid at ordinary temperatures). One animal was fed urea for 155 consecutive days.

A typical ration consisted of 625 gm. of straw or chaff, from 125 to 223 gm. of potato starch, 125 gm. of cane sugar, and 30 gm. of urea. This provided from 16.03 to 18.14 gm. of nitrogen, of which urea furnished 13 to 14 gm., depending upon the preparation fed. On such a ration the nitrogen balance varied from 1.58 to 3.23 gm., while from 8.14 to 10.01 gm. of nitrogen appeared in the urine. These data are cited in support of the author's thesis that the bacteria in the omasum of ruminants synthesize proteins from amids when suitable carbohydrates are present, and that these proteins serve the same function in nutrition as proteins derived from the feed.

That starch and cellulose may be suitable carbohydrates was indicated by two of the experiments. In one of these the starch ration was increased to 336 gm. with the omission of sugar, and in the other the straw ration was increased to 1 kg. with the omission of both sugar and starch. The nitrogen balances were 1.53 and 0.4 gm., respectively, and it is estimated that 76.1 and 93.9 per cent of the proteins derived from urea were digested.

The two tests in which urea was omitted were not exactly comparable to the others, since in one case the entire roughage and carbohydrate ration was cut in half, and in the other mineral yeast was fed in conjunction with the straw. With the reduced ration the nitrogen balance was distinctly negative, but the mineral yeast formed a satisfactory source of protein, as had previously been reported by the author (*E. S. R.*, 43, p. 367).

The experiments also provides a basis for studying the influence of the duration of hydrolysis on the feeding value of the straw and chaff. Chaff treated for 18 hours was distinctly richer in digestible organic matter than chaff treated for 3 hours, while straw treated for 24 hours contained slightly more digestible organic matter than straw treated 12 or 72 hours.

Note on the formation of protein from urea by ruminants, E. SALKOWSKI (*Hoppe-Seyler's Ztschr. Physiol. Chem.*, 109 (1920), No. 6, pp. 276-279).—The author doubts that proteins were synthesized from urea in Völtz's experiments, claiming that the hydrolyzed straw could not furnish the necessary sulphur.

The digestibility and utilization of the nutrients of the oil fungus (*Endomyces vernalis* Ludwig) by carnivora and herbivora (ruminants), W. VÖLTZ, W. DIETRICH, and A. DEUTSCHLAND (*Biochem. Ztschr.*, 114 (1921), No. 3-4, pp. 111-128, fig. 1).—The oil fungus studied by the authors is rich in fat, resembling olive oil in taste and appearance. It was used in digestion experiments with sheep and dogs because of its possibilities as a source of fat during the wartime shortage.

On the dry basis the fungus contained 23.2 per cent of crude protein, 27.9 per cent of ether extract, and 44.2 per cent of carbohydrates. Sheep fed the fungus in conjunction with meadow hay digested 74.9 per cent of the organic matter of the fungus, 65.4 per cent of the protein, and 79.7 per cent of the fat. Dogs fed the untreated fungus (along with meat) digested 59.4 per cent of the organic matter and 57.8 per cent of the fat. The low digestibility in the case of dogs is attributed to the fact that many apparently unaltered fungus cells appeared in the feces. When the fungus was heated for two days at 90° C. to destroy the cell wall and then fed to dogs, 84.7 per cent of the crude fat was digested, but the digestibility of the crude protein and total organic matter was reduced. When the extracted oil was fed to dogs, 86.7 per cent of the ether extract was digested.

On a simple process of determining approximately the digestibility of the cellulose fraction of plant fibers, particularly woody fibers, P. WAENTIG and W. GIERISCH (*Hoppe-Seyler's Ztschr. Physiol. Chem.*, 103 (1918), No. 2-4, pp. 87-103).—The authors report data on the ability of horses to digest the crude fiber (as determined by the Weender method) in samples of ground fir and pine wood, hydrolyzed wood meal, various kinds of paper pulp, and variously prepared hydrolyzed straws. For each material the "chlorin number" is also given, i. e., the percentage increase in the dry weight following exposure to chlorin gas. The authors believe with Cross and Bevan that the chlorin is absorbed chiefly by the lignin present and that the lignin content is proportional to the chlorin number. In general, the digestibility of the fiber decreased as the chlorin number increased, and the determination of the latter is recommended as a convenient method of estimating the digestibility of fiber-rich materials suggested for use as feeding stuffs.

On the evaluation and digestibility of feeding stuffs containing crude fiber, F. W. SEMMLER and H. PRINGSHEIM (*Landw. Vers. Sta.*, 94 (1919), No. 1-2, pp. 85-96).—The authors find that the Waentig-Gierisch chlorin number in the case of various straws and similar products is about 1.4 times the percentage of lignin as determined by the somewhat tedious direct methods, and recommend the use of this fact to estimate the lignin content. In straw hydrolyzed by the Beckmann process, however, the lignin percentage was equal to only half the chlorin number. It is pointed out that usually less than 50 per cent of the crude fiber of natural products is digested when the lignin content is in excess of 20 per cent, but that up to 75 per cent may be digested in the case of straw hydrolyzed by sodium hydroxid despite a much higher lignin content,

Contributions to the knowledge of hemicellulose digestion in the higher animals and the presence of hemicellulose in animal glands, together with supplementary remarks on the structure of wheat bran, F. WILLE (*Landw. Jahrb.*, 52 (1918), No. 3, pp. 411-430, pls. 2).—The author reports observations indicating the presence of a hemicellulose-digesting enzyme in the parotid glands and the gall of cattle and swine, and in the stomach, pancreas, and small intestine of swine. In cattle the abomasum, small intestine, caecum, and large intestine have a slight digestive action, but not the omasum or the pancreas. Ammonium sulphate extracts of the tissues also contained the enzyme. The test materials used as sources of hemicellulose were wheat bran, slices of the endosperm of lupine seeds, and cross sections of the rhizomes of *Molinia coerulea*. From a survey of the known relationships of the hemicelluloses, it is concluded that they form a natural group which should be treated as distinct from crude fiber and nitrogen-free extract.

The author appends some notes on the structure of wheat bran, calling attention particularly to the complicated structure of the pericarp. In the feces of cattle fed wheat bran he has identified microscopically only the cross cells and the tube cells of the pericarp and the brown cells of the spermoderm, the rest being digested. Swine appear to digest all but the mesocarp cells.

The presence of a hemicellulose-splitting enzyme in resting seeds and the alleged solution of hemicelluloses by the enzymes of higher animals, A. RIPPEL (*Landw. Vers. Sta.*, 97 (1921), No. 3-4, pp. 179-193).—In seeds of *Lupinus angustifolius*, *Galium aparine*, and *Asparagus officinalis* the author finds enzymes capable of digesting the hemicelluloses of the seeds, and takes the view that the digestive effects observed in Wille's experiments with animal tissues were produced in part at least by the plant enzymes introduced with the hemicellulose material.

The fermentation of cellulose in the paunch of the ox and its significance in metabolism experiments, A. KROGH and H. O. SCHMIT-JENSEN (*Biochem. Jour.*, 14 (1920), No. 6, pp. 686-696).—The authors have studied the fermentation in vitro of material collected immediately after slaughter from the rumen of 8 cows that had been fed hay and straw exclusively for several days.

Except in one experiment where calcium carbonate had been added the ratio of carbon dioxide to methane varied from 2.2 to 2.95, the average being 2.6. Due, it is believed, to the unavoidable admission of oxygen, the methane production in the fermentation tubes was much below that occurring in the living animal, but since the ratio $\text{CO}_2:\text{CH}_4$ did not vary systematically with rapidity of fermentation in the samples studied, it is concluded that the average ratio represents substantially that occurring in vivo. The use of this average to correct the apparent respiratory quotient determined from metabolism trials is illustrated by means of data on the gaseous metabolism of cattle collected by A. C. Andersen. The authors accept the statement of Markoff (*E. S. R.*, 30, p. 670) that the fatty acids produced during cellulose fermentation have the average composition of butyric acid. This would give a $\text{CO}_2:\text{CH}_4$ ratio of 3. The deviation of the average from the expected ratio is not attributed to the formation of higher fatty acids.

No hydrogen was detected among the products of fermentation, and the authors believe that published reports of small quantities of hydrogen are due to experimental errors. The character and intensity of the fermentation was found not to be influenced by the natural variations in the H-ion concentration of material in the rumen (pH between 7 and 8). Free nitrogen was neither produced nor absorbed in appreciable amounts in the fermentation process.

The cellulose fermentation in the rumen of the ox and its significance for metabolism investigations, W. KLEIN (*Biochem. Ztschr.*, 117 (1921), No. 1-2, pp. 67, 68).—Commenting on the paper of Krogh and Schmit-Jensen noted above, the author objects to the correction of the respiratory quotient by the use of an average value of the ratio $\text{CO}_2:\text{CH}_4$. He calls attention to the fact that in an earlier paper (E. S. R., 35, p. 271) he also reported determinations of the latter ratio and found it to vary from 2.6 to 2.73. It is claimed that these variations can not be neglected.

The respiratory quotient and its uncertainty, J. A. FRIES (*Amer. Jour. Physiol.*, 55 (1921), No. 1, pp. 53-64).—The author reports determinations of the respiratory quotient of two cows at the Pennsylvania Institute of Animal Nutrition. The experiments were made in the open circuit respiration calorimeter, and the oxygen consumption was estimated by a new method involving the passage of the air over heated charcoal to remove the oxygen.

The apparent respiratory quotients uncorrected for cellulose fermentation in the rumen were 1.552 and 1.618, respectively, for the two cows. If the ratio $\text{CO}_2:\text{CH}_4$ in the fermentation gases be taken equal to 2.81, the factor determined by Möllgaard and Andersen (E. S. R., 39, p. 676), the corrected pulmonary respiratory quotients would be 1.154 and 1.210, respectively. If use is made of the ratio 3.68 observed by Markoff (E. S. R., 30, p. 670) in gas collected from the rumen, the corrected quotients would be 1.031 and 1.078, and finally if the ratio 5.19 is used, as suggested by Markoff to allow for the absorption of CO_2 from the alimentary tract and its discharge through the lungs, the corrected values would be 0.816 and 0.856. The variations in the respiratory quotient observed in the human subject by Benedict (E. S. R., 19, p. 864) and Carpenter (E. S. R., 34, p. 260) are cited to show that the fermentation of cellulose does not exhaust the sources of error in the determination of the respiratory quotient, and the author concludes, therefore, that the uncertainty as to its true value makes the respiratory quotient impossible of use as a short cut to the accurate computation of the energy metabolism of an animal.

The feeding of productive farm animals, M. KLIMMER (*Fütterungslehre der Landwirtschaftlichen Nutztiere*. Berlin: Paul Parey, 1921, 3. ed., rev. and enl., pp. X+240, figs. 94).—The section on feeding in the author's Veterinärhygiene (E. S. R., 32, p. 79) is here revised and published separately as volume 2 of the third edition. The topics discussed include the chemical composition, preservation, classification, and control of feeding stuffs and brief suggestions for feeding the various classes of farm animals, including poultry and fishes.

The calculation of the money value of feeding stuffs, J. KÖNIG (*Fühling's Landw. Ztg.*, 67 (1918), No. 3-4, pp. 41-62).—The method of least squares is employed to evaluate the relative contributions to the market price of the protein, fat, and nitrogen-free extract present in feeds. Using the analyses of 23 concentrates sold in Westphalia and the average prices of each in 1910 and 1913, and taking the value of a kilogram of nitrogen-free extract as the unit, the author finds that a kilogram of crude protein has a value of 2.04 and a kilogram of crude fat a value of 2.29. Using 18 concentrates and 1907-1909 prices, the protein and fat values are 1.86 and 1.63, respectively. Determinations by W. Henneberg are cited to show that these values in 1874-1879 were 3.1 and 4, respectively. Taking the value of digestible nitrogen-free extract as the unit, the author also finds that the relative values of digestible protein and digestible fat were 1.61 and 2.8, respectively, with the 1910 and 1913 average prices, and 1.51 and 1.99 in 1907-1909.

On the economics of feeding stuffs, E. MARENGHI (*Atti R. Accad. Georg. [Florence]*, 5. ser., 16 (1919), No. 2-3, pp. 86-97).—A discussion of the selection of feeds for live stock with reference to their cost and nutritive value.

A criticism of the least square method of determining the monetary value of the constituents of feeds is included. The author holds that when the natural classes of feeds (e. g., the oil cakes or the hays) are treated separately the variations in chemical composition within a class are so small that price variations are due more to accidental circumstances than to the chemical differences, and consequently the set of normal equations derived are essentially indeterminate. On the other hand, if several classes of feeds are combined, the variation in chemical composition is so great that the coefficients determined are apt not to represent actual conditions within a class. The use of arbitrary weights is considered sufficient where the relative monetary values of the constituents are desired for the purpose of making rebates in the case of feeds not meeting the required standard.

The estimation of the chaff content and feeding value of mill offals of the cereal grains to which chaff has been added, H. NEUBAUER (*Landw. Vers. Sta.*, 94 (1919), No. 1-2, pp. 9-40).—The author claims that the amount of chaff added to cereal by-products can be closely estimated by determining the ratio of crude fiber to total organic matter. Algebraic formulas are presented for computing the chaff content from this ratio and also for estimating the influence of the chaff on the digestibility of the product.

The quantitative botanical analysis of stock feed mixtures, J. A. EZENDAM (*Dept. Landb., Nijv. en Handel [Nederlands], Verslag. Landbouwk. Onderzoek. Rijkslanbouwproufst.*, No. 25 (1921), pp. 1-82, pls. 6).—The author presents results of microscopical counts and measurements of ground plant products in mixtures made up of known ingredients of known weight, for the purpose of enabling the microscopist to make a quantitative estimate of the ingredients and adulterants in mixed feeds.

A comparison of corn silage and sorghum silage for fattening steers, E. S. GOOD, L. J. HORLACHER, and J. C. GRIMES (*Kentucky Sta. Bul.* 233 (1921), pp. 61-89, figs. 8).—Three experiments are reported in which steers were fed corn, cottonseed meal, and corn or sorghum silage, together with straw, and in one case corn stover. The daily gains of the lot fed corn silage were greater in each experiment than the sorghum-silage lot, the difference being greatest in the shortest experiment (1917-18). The data as to the economy of gain are summarized in the following table:

Feeds consumed per pound of gain by steers in three silage-feeding experiments.

Kind of silage fed.	1917-18 (90 days).				1918-19 (150 days).				1919-20 (165 days).			
	Ear corn. ¹	Cotton-seed meal.	Silage.	Straw and stover.	Shell-ed corn. ²	Cotton-seed meal.	Silage.	Straw.	Shell-ed corn. ³	Cotton-seed meal.	Silage.	Straw.
Corn.....	Lbs. 0.83	Lbs. 1.62	Lbs. 20.7	Lbs. 2.28	Lbs. 2.39	Lbs. 1.80	Lbs. 21.3	Lbs. 0.2	Lbs. 3.73	Lbs. 2.05	Lbs. 23.0	Lbs. 1.47
Sorghum....	1.02	2.24	26.7	3.02	2.59	1.96	23.2	.4	3.80	2.10	24.0	1.62

¹ Fed last 35 days only.

² Last 90 days.

³ Last 105 days.

The sorghum silage, as shown by the proximate analyses which are tabulated, contained less protein and somewhat more crude fiber per unit of dry weight than the corn silage. Field studies extending over five years indicated an average yield of 10.75 tons of silage per acre of corn and 16.78 tons of silage per acre of sorghum. It is estimated that the corn silage yielded by one acre,

together with the supplementary feeds consumed, produced 996 lbs. of beef, while sorghum on a similar comparison produced 1,359 lbs. "The chief advantages to be derived from substituting sorghum for corn as a silage crop are that sorghum will stand a drought better than corn and is not so easily hurt by frost."

Shorthorns in central and southern Scotland, J. CAMERON (*Edinburgh and London: William Blackwood & Sons, 1921, pp. XV+335, pls. 9*).—This consists mostly of descriptions of existing herds of Shorthorns in Scotland, with notes on the early history and recent development of the breed.

Sheep feeding investigations.—Wintering breeding ewes, A. E. DARLOW (*Amer. Sheep Breeder and Wool Grower, 41 (1921), No. 8, pp. 395, 396*).—The author reports a 90-day experiment with 5 lots of 15 pregnant ewes, in continuation of the work reported in *Oklahoma Station Bulletin 125 (E. S. R., 42, p. 264)*.

Four lots received darso silage and alfalfa hay as roughage. The grains fed in the respective lots and the total gains per ewe were as follows: No grain, 13.3 lbs.; whole kafir, 21.3 lbs.; ground kafir, 18 lbs.; and ground darso, 12 lbs. The fifth lot fed sunflower silage, alfalfa hay, and ground kafir gained only 1.8 lbs. per ewe.

The feeding of sheep in times of drought, W. L. HINDMARSH (*Agr. Gaz. N. S. Wales, 32 (1921), Nos. 6, pp. 381-386; 7, pp. 491-496; 8, pp. 543-547*).—This article is based on a survey of methods used in feeding sheep during the 1919-20 drought in New South Wales. Native scrub vegetation, hay, dried grass, leaves, legume silage, pumpkins, melons, etc., were fed, usually with a limited amount of grain.

Missouri plan of flock improvement, T. S. TOWNSLEY (*Missouri Agr. Col. Ext. Circ. 105 (1921), pp. 20, figs. 5*).—The plan outlined contemplates the establishment of numerous demonstration poultry farms throughout the State where definite records will be kept to determine the profitableness of the practices advocated. A scheme of pedigreed breeding of standard bred poultry is part of the plan.

The increase in weight and the quantitative and qualitative modification of the wool of lambs subjected to unilateral thyroidectomy with or without castration, G. AGNOLETTI (*Clin. Vet., Rass. Polizia Sanit. e. Ig. [Milan], 43 (1920), No. 10-11, pp. 245-269*).—The author has studied the growth and the wool characters of three lambs of the Bergamask and Valtelline breeds, two of which had been subjected to unilateral thyroidectomy and castration shortly after weaning, and the third to unilateral thyroidectomy alone. Castrated lambs formed the controls for the first two and a normal ram lamb a control for the third.

In the three cases the hypophysis (pituitary) and the thymus in the controls were heavier than in the experimental animals, and in two cases this was also true of the adrenal capsules. The surviving thyroids of the experimental animals became somewhat enlarged. Thyroidectomy caused an increase in the live weight and a lengthening of the wool fiber, with a reduction in its diameter and strength but an increase in its elasticity. Thyroidectomy is considered a simple operation and is recommended as a routine procedure at the time of castration. The paper forms one of a series on the influence of the endocrine glands on development initiated by Pugliese (*E. S. R., 45, p. 769*).

Principles of wool combing, H. PRIESTMAN (*London: G. Bell & Sons, Ltd., 1921, 2. ed., rev. and enl., pp. XII+236, pls. 8, figs. 76*).—This treatise, originally published in 1904, deals in considerable detail with the carding, combing, and finishing of wool. Introductory chapters treat of the classification of wool, wool washing, and the testing and softening of water for washing.

The influence of age on fertility in swine, T. ELLINGER (*Natl. Acad. Sci. Proc.*, 7 (1921), No. 5, pp. 134-138, fig. 1).—This paper deals with the records of 134 sows of the Danish breed, each of which produced 10 litters. It was found that litter size increased somewhat in successive parturitions up to the seventh or eighth, after which there was a slight decline. Treating the serial number of the litter as a continuous variable, the author fits the data to a curve similar to that in use at the Maine Experiment Station (E. S. R., 44, p. 675) to express milk flow as a function of age. The equation derived is

$$y=8.414+0.915x-0.078x^2+1.627 \log x$$

where (y) is the size of the litter and (x) is its number.

Swine mineral mixtures, J. M. EVVARD (*Iowa Sta. Circ.* 70 (1921), pp. 2).—Formulas are given for three mineral mixtures that have been found valuable as supplements to corn and tankage for hogs. The author makes it clear that attempts at the commercial exploitation of these mixtures is not countenanced by the station.

Growth of thoroughbred colts, J. J. HOOPER (*Breeder's Gaz.*, 80 (1921), No. 8, p. 251).—The author presents data collected on a large Kentucky horse-breeding farm showing the heights, girths, and weights of 10 thoroughbred colts and 10 fillies at birth and by monthly intervals between the ages of 7 and 15 months. These animals made an average gain of 2 lbs. daily in this time, and the colts gained $1\frac{1}{2}$ in. a month in height.

Seventh and eighth Irish egg-laying competitions, L. MURPHY (*Ireland Dept. Agr. and Tech. Instr. Jour.*, 20 (1919), No. 1, pp. 20-38, pls. 3; 21 (1921), No. 1, pp. 69-93, pls. 4).—In continuation of the records of the egg-laying trials held annually from October 1 to August 31 at Munster Institute, Cork (E. S. R., 40, p. 671), these pages give details of the tests terminated in 1919 and 1920. The monthly egg records of the individual hens and the number of times each was broody are tabulated. A feature of the eighth contest was the inclusion of descendants of prize winners of previous years.

Color production in relation to the colored feathers of birds, A. MALLOCK (*Zool Soc. London, Proc.*, 1921, II, pp. 221-228, figs. 4).—The author has studied the "metallic" feathers of ducks, peacocks, humming birds, birds of paradise, etc., by placing pieces under a microscope between a quartz plate and a plano-convex lens of large radius. Compression of the barbules at once destroyed the color and revealed an opaque black substratum. This behavior is considered conclusive proof that the metallic appearance is an interference phenomena, i. e., due to periodic or recurring structural elements (laminations) in the feather substance, with the interval or period a multiple of half of the wave length of the light reflected. Other tests that have been cited to prove this point, such as the color changes following either immersion of the feathers or a shift in the angle of incidence, are not considered conclusive. Color production is confined to an extremely thin layer of the barbule superimposed upon a pigmented background.

Fish culture on the farm, G. BERG (*Ind. Dept. Conserv., Pub.* 9 (1920), pp. 23, figs. 17).—The construction of small fishponds, the selection of fish suitable for ponds, and the management of the food supply for the fish are described.

DAIRY FARMING—DAIRYING.

Treatise on dairying, W. FLEISCHMANN (*Lehrbuch der Milchwirtschaft. Berlin: Paul Parey, 1920, 6. ed., rev., pp. VIII+633, pls. 3, figs. 60*).—This edition, issued posthumously, differs but little from the fifth (E. S. R., 34, p. 670), although new material has been added in several places.

Judging dairy cattle, G. C. HUMPHREY (*Wisconsin Sta. Bul.* 335 (1921), pp. 44, figs. 21).—Directions are given for judging dairy cattle by the score card and by the study of the pedigree and production records.

Milk production of young cows, J. J. HOOPER (*Jour. Heredity*, 12 (1921), No. 4, p. 166).—The milk and butter-fat records of 365 Jersey cows on yearly official tests are averaged by year of age. It was found that the average 2-year-old exceeds her butter-fat requirement for admission to the Register of Merit by 30 per cent, while a 6-year-old exceeds her required record by only 22 per cent.

Amino acids of the blood as the precursors of milk proteins, C. A. CARY (*Jour. Biol. Chem.*, 43 (1920), No. 2, pp. 477-489).—In experiments conducted in the Dairy Division of the U. S. Department of Agriculture, nine sets of samples of blood were collected nearly simultaneously from the jugular and mammary veins of cows, i. e., before and after the passage of the blood through the udder. From analyses of the samples collected on six occasions from lactating cows, it is estimated that about 33 gm. of α -amino-acid nitrogen (equivalent to 300 gm. of milk protein) are abstracted daily from the blood plasma by the mammary glands of cows giving 10 liters of milk per day. Since the differences between the plasmas of the two veins were fairly constant in the lactating cows and were not proportional to the milk yields, it is suggested that the added milk proteins required for high yield are secured by an increase in the rate of flow of blood through the mammary gland. In dry cows there were no essential differences between the two plasmas.

In four of the cows, determinations of the CO_2 capacity of the plasma in the two veins were made by N. R. Blatherwick. The CO_2 capacity was higher in the mammary vein, and in the case of both veins was greater in the lactating than in the nonlactating cow.

Neutrality regulation in cattle, N. R. BLATHERWICK (*Jour. Biol. Chem.*, 42 (1920), No. 3, pp. 517-539).—In connection with the studies on the physiology of milk secretion undertaken by the Dairy Division, U. S. Department of Agriculture, the author determined the capacity of the blood plasma of cows and calves to combine with carbon dioxid. In the 22 determinations made with cows the plasma CO_2 capacity varied from 55.1 to 68.3 cc. per 100 cc. of plasma, the average being 61.5 cc. In 7 calves two weeks of age or younger the average was 73 cc., with a minimum value of 68.3 cc. and a maximum of 80.6. The CO_2 combining power of the plasma of 2 of the calves at the age of one month had become reduced practically to the adult level.

A cow that was fasted for 7 days failed to show any reduction in the CO_2 capacity. An increase in the inorganic phosphorus in the plasma after the first day of fasting is interpreted as an early mobilization of the mineral reserves to aid in maintaining tissue neutrality. When cows were fed exclusively on grain (an acid-forming ration) the CO_2 capacity was reduced, while with a ration of alfalfa hay (base forming) the CO_2 capacity was increased. With corn silage, the salts of which contain excess of basic elements, the CO_2 capacity decreased and the urine became acid, contrary to expectation. This is attributed to the incomplete oxidation of the organic acids of silage. The amount of calcium in the plasma was influenced by the quantity in the ration, but the changes were small compared with the variations in the intake. An experiment with a calf fed hydrochloric acid failed to show that the amount of calcium in the plasma is dependent upon the bicarbonate content.

Comparative investigations of the influence of calcium chlorid and calcium carbonate on milch animals, A. MORGEN, H. WAGNER, G. SCHÖLER, and E. OHLMER (*Landw. Vers. Sta.*, 94 (1919), No. 1-2, pp. 41-83).—Extensive calcium balance experiments with lactating goats and sheep are reported, from

which it is concluded that calcium chlorid is as satisfactory as calcium carbonate for use as a source of calcium for the animal organism provided the intake is not excessive. In some of the experiments the salts were taken in the form of mineral (bath) waters. Incidental reviews are included of the somewhat controversial literature concerning the use of calcium chlorid as a mineral supplement to animal feeds in Germany.

The market milk business in New Jersey, P. B. BENNETCH (*N. J. Dept. Agr. Bul.* 25 (1920), pp. 32, figs. 14).—This is a discussion of market milk prices, the cost of cattle feeds, and the problems of milk distribution. It is noted that in the Oranges compulsory pasteurization effected unexpected economies in distribution by forcing several small dealers to combine.

Dairy laws revised to April 30, 1921, compiled by P. M. HARWOOD (*Mass. Dept. Agr., Dept. Bul.* 38 (1921), pp. 34).—This supersedes a pamphlet previously noted (*E. S. R.*, 42, p. 673).

Milk control in dairy plants in large cities, R. MEURER (*Ztschr. Fleisch u. Milchhyg.*, 31 (1921), No. 19, pp. 253-260, fig. 1).—A detailed description is given of the methods of chemical and bacteriological control used in operating the milk plant of the Konsumverein of Oldenburg.

Standard methods for the bacteriological examination of milk, W. H. PARK ET AL. (*Boston: Amer. Pub. Health Assoc.*, 1921, 3. ed., pp. 24, fig. 1).—This edition is much more elaborate than the second (1916). Directions for making macroscopic colony counts (Petri plate method) are given in detail, and include methods for determining the H-ion concentration of agar media. Directions for making the direct microscopic count (Breed method), the microscopic colony count (Frost's little-plate method), and the sediment test are included.

The Breed method is recognized as official for unpasteurized milk. In view of the fact that the plate counts represent colonies rather than individual bacteria in the original milk, it is suggested that the expression "official plate count 2,000,000" be substituted for "2,000,000 bacteria per cubic centimeter" when agar plate counts obtained by the standard technique are reported.

There is a bibliography of 30 references.

The limitations of the reductase test for dairy work, O. RAHN (*Milchw. Zentbl.*, 49 (1920), Nos. 21, pp. 287-290, fig. 1; 22, pp. 299-303; 23, pp. 311-315).—The author cites data indicating considerable variation in the time required for decolorizing methylene blue in the reductase test, and shows that this is due partly to the preponderance of different types of bacteria and partly to temperature differences. Accordingly, the reductase test is considered of value only for mixed milk having an "average flora." The optimum temperature is considered to be from 38 to 40° C., since decolorization is then most rapid.

Report on a bacteriological investigation of Dublin milks and the pure milk problem, J. W. BIGGER (*Dublin: Ireland Local Govt. Bd.*, 1921, pp. 42, pls. 2).—The author reports results of a bacteriological examination of 100 samples of milk collected throughout a year in Dublin. Most of the counts were excessively high, and tubercle bacilli and lactose fermenting organisms were common. It is thought that most of the contamination resulted from carelessness in milking. The problem of improving the supply, aside from pasteurization, is discussed, with particular regard to the tuberculin test and the establishment of a grading system on the basis of the bacteriological count.

An inquiry concerning the state of cleanliness of empty milk churns, R. H. CUMMING and A. T. R. MATTICK (*Jour. Hyg. [Cambridge]*, 19 (1920), No. 1, p. 84-86).—The authors examined 500 empty milk cans as returned to a

railroad platform and found that 16 per cent were dry and apparently clean, 28 per cent wet and apparently clean, 25 per cent had a bad odor, and 31 per cent showed traces of milk or had not been washed at all. Bacteriological examination of 21 of the cans showed only 5 that were satisfactorily cleaned and did not contain lactose-fermenting organisms.

The sterilization of empty milk churns by steam under pressure, A. T. R. MATTICK (*Jour. Hyg. [Cambridge]*, 20 (1921), No. 2, pp. 165-172).—As a continuation of the work of Cumming and Mattick, noted above, the author reports three series of experiments in sterilizing milk cans heavily contaminated with bacteria from sour milk or sour whey. The cans and lids were washed with hot water and then steamed. Bacteriological conditions within the cans 24 hours later were usually not satisfactory unless the steaming lasted three minutes and the lids had been put on the cans as soon as the steam escaped.

A study of brown glass milk bottles with special reference to their use in preventing abnormal flavors due to light, B. W. HAMMER and W. A. CORDES (*Iowa Sta. Research Bul.* 64 (1920), pp. 99-111).—In the experiments reported, milk exposed to sunlight in brown glass bottles had a higher bacterial content than milk exposed in ordinary milk bottles. This was due partly to the higher temperature of the milk in the brown bottles and partly to the absence of the germicidal effect of sunlight. Exposure to direct sunlight in the ordinary bottles bleached the milk and caused the development of a pronounced tallowy flavor. These effects were absent from the brown bottle samples. The commercial use of brown bottles is not recommended because the cream line is not visible and sediment can not be readily observed, but consumers are advised to keep ordinary bottled milk sheltered from the direct rays of the sun.

The manufacture of glass milk bottles, A. L. BROWN (*Glass Indus.*, 2 (1921), No. 11, pp. 259-262).—An account is given of the mixture used and methods followed in making glass milk bottles, and the advantages of the glass milk bottle over other containers are considered.

One of the first considerations in making glass milk bottles is the color. "This color is just a faint tint of pink which gives a richer appearance to the milk. Should there be too much color in the bottle the milk will look bloody, especially if there are any streaks. On the other hand, should the color be too low, and of course by low is meant green, the milk will look weak and thin."

Two organisms of a commercial lactic starter, S. H. AYERS and C. S. MUDGE (*Jour. Dairy Sci.*, 4 (1921), No. 3, pp. 240-249).—The authors, working in the Dairy Division of the U. S. Department of Agriculture, isolated cultures of two streptococci from a commercial butter starter. One organism was a strain of the *Streptococcus lacticus* group and the other corresponded to the *S. kefir* type. The former in pure culture produced but little volatile acid in milk although the total acidity was high. The latter, however, in the presence of the former caused production of volatile acids in considerable quantities. The characteristic acidity and flavor of the original starter was reproduced when the two organisms were combined in one culture. The pronounced associative action of the two organisms is attributed to the fact that *S. lacticus* converts the nitrogenous material of the milk into a form readily available for *S. kefir*, thereby promoting the growth of the latter.

Volatile acid production of *Streptococcus lacticus* and the organisms associated with it in starters, B. W. HAMMER (*Iowa Sta. Research Bul.* 63 (1920), pp. 59-96, 96a-96c).—The author describes the cultural and morpho-

logical features of *S. citrovorus* and *S. paracitrovorus* n. s., two organisms found associated with *S. lacticus* in starters, and reports observations on the acid production of starters containing these organisms. *S. citrovorus* does not grow on whey agar at 37° C. and does not alter the color of litmus milk. *S. paracitrovorus* makes the same growth at 37° as at room temperature and turns litmus milk red, usually without coagulation. *S. citrovorus* is common in commercial starters, and was the type whose acid production was discussed in Research Bulletin 55 (E. S. R., 43, p. 75). *S. paracitrovorus* was found only rarely in commercial starters.

Each of the associated organisms causes the production of volatile acid when grown in cultures with *S. lacticus*. The author's experiments indicate, at least in the case of *S. citrovorus*, that it is the lactic acid produced by *S. lacticus* and not the presence of a living lactic acid bacterium which enables the associated organism to grow and produce volatile acid. The optimum concentration of lactic acid for growth of the associated organisms was lower than the maximum lactic acid producing capacity of *S. lacticus*. Both organisms were able to utilize citric acid as a source of volatile acid. Since citric acid is a normal constituent of milk, it is suggested as a source of the volatile acid produced by the associated organism when grown in pure cultures. Of the two, *S. paracitrovorus* has a greater capacity for producing volatile acid. There was also indication that this species can of itself produce a small amount of lactic acid.

In commercial cultures and in starters carried by creameries *S. lacticus* was found to be much more numerous than its associated organisms, forming in some cases more than 90 per cent of the flora.

There is a bibliography of about 40 titles, mostly bacteriological studies on the ripening of cream.

The type of lactic acid produced by starters and by the organisms isolated from them. B. W. HAMMER (*Iowa Sta. Research Bul.* 65 (1920), pp. 115-128).—The author prepared zinc salts of the lactic acid produced by starters, and studied their optical properties, sometimes by direct observation with the polariscope but more frequently by determining the percentage of water of crystallization.

In all the commercial starters examined the lactic acid was partly in the inactive form. Since pure cultures of *Streptococcus lacticus* were known to produce only *d*-lactic acid, it is concluded that the starters were mixed cultures. A study of mixed cultures of *S. lacticus* and the two associated organisms described in Research Bulletin 63, noted above showed that some inactive lactic acid was always present although the percentage was variable, particularly with *S. citrovorus*. The presence of living *S. lacticus* in the mixed cultures was not necessary for the production of the inactive acid, provided some *d*-lactic acid had been formed before the destruction of *S. lacticus*. Of the two associated organisms *S. paracitrovorus* was the more active in producing *l*-lactic acid. Some results were obtained which indicate that both organisms may be able to change *d*-lactic acid into *l*-lactic acid, but critical test of this was not secured owing to the lack of a suitable medium free from citric acid and carbohydrates.

New angles to the starter-maker's problem. B. W. HAMMER (*Jour. Dairy Sci.*, 4 (1921), No. 4, pp. 277-285).—The author reviews the work reported in the two publications noted above and discusses the results with reference to the making of starters.

VETERINARY MEDICINE.

A practicum of bacteriology and protozoology (*Praktikum der Bakteriologie und Protozoologie* Jena: Gustav Fischer, 1920, 4. ed., rev. and enl., pts. 1, pp. VI+130, figs. 54; 2, pp. VIII+146, figs. 128).—In the first part of this new edition of the work previously noted (E. S. R., 26, p. 882; 34, p. 876) bacteriology is dealt with by K. Kisskalt. The second part on protozoology is by M. Hartmann.

Studies on bacterial nutrition.—I—III, T. THJÖTTA and O. T. AVERY (*Jour. Expt. Med.*, 33 (1921), No. 6, pp. 763-771; 34 (1921), Nos. 1, pp. 97-114; 5, pp. 455-466).—Three studies are reported:

I. *Growth of Bacillus influenzae in hemoglobin-free media*, T. Thjötta.—Experimental evidence is presented that *B. influenzae* will grow profusely on hemoglobin-free media consisting only of plain broth and emulsions or extracts of mucoid bacilli or *B. proteus*. The growth-inducing property of these emulsions and extracts is not destroyed by boiling or by filtering through Berkefeld filters. It is suggested that the growth-stimulating effect of the bacterial extracts is due possibly to substances of the same nature as vitamins.

II. *Growth accessory substances in the cultivation of hemophilic bacilli*, T. Thjötta and O. T. Avery.—In a further investigation of the growth requirements of the so-called hemophilic bacilli and of the significance of growth accessory substances in bacterial nutrition, the addition to plain broth of extracts of yeast, tomatoes, green peas, or beans in dilutions as high as 1:1,000 sufficed to initiate growth of *Bacillus influenzae* when seeded from blood media, and to maintain growth for one or two transfers but not more. In the case of the tomato the extract was prepared by boiling crushed ripe tomatoes for 10 minutes, filtering the juice through a Berkefeld filter or centrifuging, and adjusting the extract to the original H-ion concentration of pH=4.2. With the other materials an aqueous suspension of the material was adjusted to pH=4.6, boiled for 10 minutes, and filtered or decanted. The extracts were found to lose their activity on autoclaving and on adsorption by bone charcoal. These properties, combined with the fact that the extracts resist boiling for 10 minutes and filtering through a Berkefeld filter, point to a chemical nature analogous to that of vitamin B.

The failure of continued growth of *B. influenzae* in a simple medium enriched by one of these extracts is attributed to the exhaustion of the second heat-stable growth factor carried over from the original blood culture. The authors conclude, therefore, that "the hemophilic bacteria of which *B. influenzae* serves as a type require for their growth two distinct and separable substances, both of which are present in blood and neither of which alone suffices. These substances are (1) a vitamin-like substance which can be extracted from red blood corpuscles, from yeast, and from vegetable cells; which is relatively heat-labile and absorbed from solution by certain agents; and (2) a so-called X substance which is present in red blood cells, is heat-stable, and acts in minute amounts."

III. *Plant tissue, as a source of growth accessory substances, in the cultivation of Bacillus influenzae*, T. Thjötta and O. T. Avery.—This is a further study of the nature of the X substance in blood.

When complemented by the V factor in the yeast extract, a 1:2,000,000 dilution of crystalline hemoglobin proved sufficient to stimulate the growth of *B. influenzae*. In media containing freshly laked blood cells both the X and the V factors were present in amounts sufficient for growth in a concentration of 1:10,000. In greater dilutions growth did not take place unless the V factor was supplied. On adding the V factor the X factor proved still

effective in concentrations as low as 1:1,000,000. The X factor was found to resist autoclaving at 120° C. for 45 minutes and to be still active in blood charcoal which reacts positively to the benzidin test. Like the V factor, it can be adsorbed by bone charcoal, the adsorption being facilitated by heat. It is considered of significance that the bone charcoal not only adsorbs the X factor but also the benzidin-reacting substance from hemoglobin.

The parallelism of the presence of the benzidin reaction in blood derivatives and their ability to promote growth of *B. influenzae* suggested that the benzidin reaction might serve as an indicator of the presence of the X factor in other substances. This was confirmed in the case of potato. Raw potato was found to furnish both the V and X factors, as shown by the fact that luxuriant and continued growth of influenza bacilli took place in media containing no blood derivatives, meat extractives, or animal peptones provided unheated potato was added to the medium. Unheated potato in plain buffer solutions of sodium and potassium phosphate (pH=7.5) fulfilled the necessary growth requirements of this organism.

These results are thought to be of wide significance in furnishing additional proof that bacteria as well as the higher animals require growth accessory substances. "*B. influenzae* has heretofore been considered an obligate hemophile. The present studies indicate, however, that the hemophilic property of this group of organisms has been based on a lack of knowledge of their essential nutritional needs. . . . On the basis of the facts presented, it seems not unreasonable to assume that nutritional deficiency in the cultivation of other bacteria may be overcome by the addition to culture media of the appropriate growth accessory substances."

Growth requirements of influenza bacilli, T. M. RIVERS and A. K. POOLE (*Bul. Johns Hopkins Hosp.*, 32 (1921), No. 364, pp. 202-204).—As the result of an investigation of the phenomenon of augmented growth of influenza bacilli in symbiosis with other bacteria under various conditions, the authors have arrived at the conclusion, similar to that above noted, that "two substances are essential for the growth of influenza bacilli. Both are in blood. One resists autoclaving half an hour under 15 lbs. pressure, the other does not. The autoclave-stable substance is not hemoglobin, although it may be derived from the blood pigment, and as yet has not been found outside of blood. The autoclave-labile substance has been obtained also from yeast."

The function of the symbiotic bacteria is considered to be the synthesis of the autoclave-labile factor.

Growth of influenza bacilli without blood, T. M. RIVERS (*Jour. Amer. Med. Assoc.*, 76 (1921), No. 25, pp. 1744, 1745).—The autoclave-stable factor in blood necessary for the growth of Pfeiffer's bacillus, as noted above, has been found in eggs as an autoclaved egg infusion broth, made with or without peptone, has, on the addition of yeast, supported the growth of influenza bacilli for many generations.

The nature of the effect of blood pigment upon the growth of *Bacillus influenzae*, P. FILDES (*Brit. Jour. Expt. Path.*, 2 (1921), No. 1, pp. 16-25).—The relation of the blood pigment in the culture medium to the growth of *B. influenzae* is considered to be of the same nature as the relation of the pigment to the oxidation of guaiaconic acid, the pigment acting as a catalyst to accelerate the transfer of oxygen from a peroxid in the medium to the bacillus. Similarly, the more copious growth of the bacillus on blood altered by heat or digestion is thought to be due to the fact that in the changed blood the pigment is in the form of hematin and in the unchanged of hemoglobin and methemoglobin. The hemoglobin, having a stronger affinity for oxygen, tends to divert the oxygen from the bacillus, which consequently fails to grow.

Growth of *Bacillus influenzae* without the presence of hemoglobin. A. W. WILLIAMS and O. R. POVITZKY (*Jour. Med. Research*, 42 (1921), No. 4, pp. 405-417).—This paper constitutes a further contribution to the knowledge of the growth requirements of *B. influenzae*. Evidence is presented that influenza bacilli may continue to grow in mixed mass culture with certain micro-organisms on the surface of certain media containing no hemoglobin through an indefinite number of successive culture generations, but will not grow on such media with dead cultures of the same stimulating organisms or their extracts. These results indicate that the X and V growth-promoting factors of Thjötta and Avery are present in certain living organisms.

The supposed importance of vitamins in promoting bacterial growth. J. W. McLEOD and G. A. WYON (*Jour. Path. and Bact.*, 24 (1921), No. 2, pp. 205-210).—Two lines of investigation are reported upon briefly.

The first consisted of a study of the effect of materials containing vitamin B upon the growth of *Staphylococcus aureus* in a basal medium consisting of potassium acid phosphate 0.4 per cent and agar 2.5 per cent, brought to an H-ion concentration of pH=7 to 7.6 with NaOH. To 5 cc. of this medium additions were made of materials known to contain water-soluble B, others in which water-soluble B was known to be absent, and others whose content of B was uncertain. The tubes with minimal quantities by dry weight of these substances giving growth were recorded. Amino-acid determinations of the same materials were also made.

The best results were obtained with guinea pig kidney and with a chance growth of mold. In general, substances known to contain vitamin B were more potent than those not containing it, milk and bran being exceptions. A comparison of the chemical and physical properties of yeast extract as a staphylococcus stimulant with the properties of vitamin B gave marked differences in regard to the effect of alkali and heat and precipitability of fuller's earth. A comparison of amino-acid content with potency showed that the growth was not entirely due to amino acids. Nucleic acid, uric acid, urea, caffeine, and alloxan had individually no appreciable effect.

The second part of the investigation was concerned with the nature of the growth-promoting property of fresh blood or serum for organisms like the pneumococcus and meningococcus. The method adopted was to inoculate with dilute emulsions of the bacteria under examination series of tubes of bouillon to which blood serum and other substances to be tested had been added, plate the fluid media on serum agar plates, and incubate for varying periods of time. The results obtained indicated that the growth-promoting power bears no relation to the known vitamin content. The growth-promoting power for pneumococci was to some extent destroyed by heating the serum, while that for meningococcus was only slightly altered or increased. It was also found that tryptic and peptic digestion of serum and blood completely destroyed the power of promoting the growth of meningococcus and of pneumococcus. This is thought to indicate that the growth-promoting property of blood for these bacteria must be different in nature from the known vitamins.

Food accessory factors in bacterial growth.—VI, Further observations on the substances necessary for the growth of Pfeiffer's bacillus. D. J. DAVIS (*Jour. Amer. Med. Assoc.*, 77 (1921), No. 9, pp. 683-685, fig. 1).—Attention is called to earlier papers of the author (*E. S. R.*, 39, p. 668) in which was noted the fact that in the cultivation of hemophilic bacteria there appeared to be necessary two substances. One of these is a heat-stable substance closely identified with the iron-containing pigments of the blood, and the other a factor residing in fresh animal and plant tissues and in many bacteria, and the activity of which is destroyed by autoclaving for 15 minutes or boiling for a longer time.

These earlier observations have been corroborated by recent work, and certain other observations have been noted as follows: On adding blood to a plain medium and heating to different temperatures and for increasing periods of time, it has been noted that with increasing temperature the time necessary to obtain a favorable medium for the growth of Pfeiffer's bacillus becomes less and less, as does also the time necessary to destroy the growth-promoting factor. At 60° C. growth is not profuse unless this temperature is applied for from 2 to 5 hours, but if the temperature is continued for 2 or 3 days no growth will result. At 80° growth is profuse if the medium is heated for from 5 to 10 minutes, but ceases after heating from 24 to 36 hours. At 100° a few minutes' exposure is sufficient to allow profuse growth and 1 or 2 hours to destroy the growth-promoting power. The activity of the heat-labile factor in carrot juice and in blood was destroyed by treating with small amounts of hydrogen peroxid for 1 hour.

In discussing the mechanism of the reaction between the two growth-promoting substances in blood, the possibility is suggested that the heat-labile substance may somehow control or make available the iron in the pigmented portion of the hemoglobin molecule. This raises the question, "Do vitamins or vitaminlike substances influence or to some degree control the metabolism of other elements in the body such as phosphorus, iodine, and calcium?" As substantiating this idea, attention is called to the relation apparently existing between fat-soluble A and phosphorus in the causation of rickets.

Ultravisible and filterable viruses, W. E. KING (*North Amer. Vet.*, 2 (1921), Nos. 3, pp. 112-116; 4, pp. 160-163).—In the course of the first paper, in which four recent papers relating to filterable viruses are reviewed, the author tabulates 38 affections due to such organisms, with the name of the original investigator and the year discovered. This table also includes references to the publications in which the discoveries were reported, which are to be found in the list of 43 works.

In the second paper four additional articles are reviewed.

[Report of the] department of veterinary science, J. B. PAIGE (*Massachusetts Sta. Rpt.* 1920, pp. 55a-60a).—Investigations relating to the diagnosis of *Bacterium pullorum* infection in the domestic fowl were completed during the year.

The studies relating to complications and prevention of and inherited immunity to hog cholera were continued. The work has shown beyond a doubt that hog cholera of the usual type can be prevented by the use of antihog cholera serum and virus, and there are indications that one application of the simultaneous treatment to weaned pigs possessing an inherited immunity is sufficient to protect the animal from the usual type of hog cholera throughout its life, in which case the expense and trouble of the usual practice at present of giving weaned pigs a single dose of antihog cholera serum and then at the age of 12 to 14 weeks giving both serum and virus may be avoided.

Two special problems were investigated during the year by J. B. Lentz, namely, the cause of premature birth, followed by sterility, metritis, etc., in cows, in the college herd, and the cause and control of a disease which caused the loss of a large number of birds in the flock of the poultry department. An account of the loss of chickens at the poultry plant through a disease due probably to *Micrococcus tetragenus*, by Goodale, has been noted (*E. S. R.*, 45, p. 79).

Live stock sanitary laws of Montana; also rules and regulations and orders of the Montana Livestock Sanitary Board (*Mont. Live Stock Sanit. Laws*, 1 (1921), No. 4, pp. 76).—The live stock sanitary laws, rules, regulations, and orders are brought together for ready reference.

Western sneezeweed (*Helenium hoopesii*) as a poisonous plant, C. D. MARSH ET AL. (*U. S. Dept. Agr. Bul.* 947 (1921), pp. 46, pls. 2, figs. 5).—Investigations of *H. (Dugaldia) hoopesii*, which has become very abundant on some of the more elevated and overgrazed stock ranges of the West, especially in Utah, have shown that it is the cause of the disease of sheep known as the "spewing sickness," and to be poisonous to cattle. A preliminary account of this affection by the senior author, published in 1916, has been noted (*E. S. R.*, 36, p. 680). The authors have worked out in detail the symptoms produced by the plant, the pathology, and the toxic dosage, and it has been shown that a permanent injurious effect may be produced upon the animals which eat any considerable quantity of it.

"The study of the habits of the plant and experimental work on methods of control have shown that little can be accomplished by attempts at extermination, and that restoration of the range by growth of other plants is an exceedingly slow process.

"The poisonous principle of *H. hoopesii* is an easily decomposed glucosid to which the name 'dugaldin' has been given. This is a white, amorphous solid, soluble in alcohol, less soluble in water and chloroform. With tannic acid it forms a sparingly soluble compound which is only slightly poisonous.

"There has been found no medicinal remedy which can be used effectively in treating poisoned animals. From the practical standpoint of the man handling live stock on a sneezeweed range, it is important that the herders should know the plant and appreciate the serious results from grazing upon it. Then it may be possible by proper handling of herds to prevent most of the losses."

Technique for the early diagnosis of habronemiasis, J. R. HODGKINS (*Vet. Jour.*, 77 (1921), No. 554, pp. 300, 301).—The author describes a method, consisting of syphonage, which permits reliable diagnosis in a period of some 10 minutes. The mucin thus removed from the walls of the stomach is said to contain myriads of the nematode.

Concerning rinderpest, I–V, K. SCHERN ET AL. (*Ztschr. Infektionskrank. u. Hyg. Haustiere*, 19 (1918), Nos. 3, pp. 193–196, pls. 4; 4, pp. 293–305, fig. 1; 20 (1919), No. 2, pp. 117–121; 21 (1920), Nos. 1, pp. 82–96, figs. 2; 2, pp. 122–137, figs. 2).—Several contributions by Schern and his associates on studies of rinderpest are respectively as follows: (1) Spontaneous Clinical Recovery in Rinderpest, (2) The Rinderpest Blood Findings of Braddon, (3) The Resistance and Incubation in Experimental Rinderpest of Anatolia and Podolia Cattle, (4) The Effect on Friesland Cattle of Rinderpest Serum from Anatolia and Podolia Cattle and Observations upon *Piroplasma parvum* (East Coast fever) in Turkey, and (5) Conditions Observed in Cattle Following Recovery from Experimentally Induced Rinderpest, with a Further Note on Slaughterhouse Observations of Cattle in Constantinople.

Tick control in Trinidad (*Agr. News [Barbados]*, 20 (1921), No. 504, pp. 260, 261).—This is a paper by the Government Veterinarian of Trinidad.

A fatal undiagnosed disease of cattle in the State of New York, W. A. HAGAN (*N. Y. State Vet. Col. Rpt.*, 1919–20, pp. 119–127).—The author reports upon investigations of a disease of cattle made in the fall of 1919 in Oneida County. The worst focus of the trouble, so far as present information goes, was in Oneida and Jefferson Counties, but it is known to have occurred in Oswego and Broome Counties and evidence is strong that it also occurred in Delaware County. Certain practitioners have stated that they have seen this disease each year since 1917, but in former years there were fewer cases. It is thought that in 1919 the number of cases must have run into the hundreds and perhaps thousands.

While it was thought to be hemorrhagic septicemia, the investigation indicated that it was not, or that if the affection was hemorrhagic septicemia it was of a very unusual type. All efforts thus far made to diagnose the disease have failed. While it has been regarded as infectious, the possibilities of its being caused by some plant or fungus poison was not lost sight of, since there were no lesions but what might conceivably be produced by a toxic substance from a plant.

The coccidiosis of sheep, M. LERCHE (*Arch. Protistenk.*, 42 (1921), No. 3, pp. 380-399, pl. 1).—Biological studies of the causative organism are reported.

Pseudomonas pyocyaneus Mig. as a factor in pneumonia of swine, R. R. BIRCH and J. W. BENNER (*N. Y. State Vet. Col. Rpt.*, 1919-20, pp. 104-118).—The authors report upon an outbreak of swine pneumonia kept under close observation, where *P. pyocyaneus* appeared so prominently and regularly that they believe it to be a causative factor in the losses resulting.

"We have seen this form of pneumonia affecting young and old hogs, hog cholera susceptibles, immunes, and hyperimmunes. The disease may develop either slowly or quickly. Cough, dyspnea, and thumping are prominent symptoms. Hyperimmunization seems to be a predisposing cause, as does a dusty earth floor.

"The disease traveled slowly but persistently, and was controlled effectively by isolating the sick and placing the well animals on disinfected and dampened concrete floors, thus protecting them almost entirely from dust.

"Experimentally the disease could not be produced in healthy animals in typical form either by feeding, inhalation, subcutaneous or intravenous injections, nor did healthy animals penned with the sick in quarters free from dust contract it. Some primary devitalizing influences seem to be a prerequisite. Salt solution suspension of *B. pyocyaneus* grown on slant agar, injected intravenously in large doses (20 cc.), later in smaller doses (3 cc.) to young shotes, produced immediate distress from which the animals rallied temporarily only to die of septicemia a few hours later. Still smaller doses (0.5, 1, and 2 cc.) produced a slight temporary distress followed usually by recovery, but in one case paralysis of the hind legs developed. Bouillon cultures of the organism administered intravenously in large doses produced paralysis but failed to produce death.

"We have observed this form of pneumonia in the field associated with hog cholera, with lung worm infestation, and following exposure incident to shipping or prolonged exposure in dusty yards, and in spite of the fact that we failed experimentally to transmit the disease in typical form by artificial means, our observations lead us to believe that *B. pyocyaneus*, when once it gains a foothold in the lung tissue, plays an active and important part in destroying hogs that otherwise would recover.

"Bacterins, made from the strains of the organism found active in this outbreak, administered frequently and in large doses seemed to have some curative value, but immediate and sure results following their administration were not the rule."

Stephanurosis of swine and *Stephanurus dentatus* Dies., K. J. SKRJABIN (*Bul. Soc. Path. Exot.*, 14 (1921), No. 1, pp. 47-54, figs. 5).—Records of the occurrence of *S. dentatus* are first reviewed in connection with references to the literature, followed by a technical description and drawings of the male.

On the presence of cryptococci in the digestive tube of a lymphangitic horse, DESCAZEUX (*Bul. Soc. Path. Exot.*, 14 (1921), pp. 66-69, figs. 2).—A horse which was recovering from epizootic lymphangitis died from gastrointestinal indigestion, a diagnosis confirmed at autopsy. Cryptococci were found

not only in the specific lesions but also in the gastro-intestinal canal, particularly in the stomach and small intestines, where they appeared to be saprophytic. While this is believed to be the first case of the kind recorded, the author thinks it is not an isolated one.

Studies on the chicken nematode, *Heterakis papillosa* Bloch, W. A. RILEY and L. G. JAMES (*Jour. Amer. Vet. Med. Assoc.*, 59 (1921), No. 2, pp. 208-217).—The experiments, in which eggs in the motile embryo stage were fed to incubator chicks and the progress of their development followed, led to the conclusion that this parasite does not migrate in the course of its development as does *Ascaris lumbricoides* and *Belascaris cati*. It was found that eggs subjected to a long period of freezing were capable of developing to the infective stage in practically a normal period. Low temperatures maintained for long periods, however, injuriously affected a number of eggs. As regards their effect upon a host, the author concludes that the worms are a cause of unthrifty condition and a source of loss to the poultryman.

As regards remedial and control measures, the authors state that they are convinced that the commonly recommended drugs are of little real efficacy, and that no remedy has been devised which can be said to be a satisfactory control. Their experiments show that the eggs can be reared to the infective stage with ease in a 1:1,000 solution of bichlorid of mercury, and that this is true of eggs of *Ascaridia perspicillum* also. It is pointed out that the pest can best be dealt with and avoided by the selection of clean, dry runs and well-lighted houses, kept thoroughly clean.

RURAL ENGINEERING.

Irrigation, BAROIS, A. NORMANDIN, DENAIN, JULLIDIÈRE, E. BÉLIME. CARLE, HARDEL, A. CHUDEAU, and H. ROUSSILHE (*Cong. Agr. Colon. [Paris], 1918, Compt. Rend. Trav.*, vol. 1, pp. 361-550).—This section contains a number of reports on questions relating to irrigation, including irrigation in Java, British India, Indo-China, French India, Madagascar, and French Central and West Africa.

Administration report, with statistical statements and accounts for 1919-20, F. W. WOODS and F. D. GORDON (*Punjab Irrig. Dept. Admin. Rpt. 1919-20*, pp. VII+10+V+42+43+III+77, pls. 20).—This report covers the work of the Punjab Irrigation Department for the year 1919-20, and contains statements with diagrams indicating areas irrigated by major and minor irrigation works and financial results of Punjab canals for the year.

Conveyance losses of water on U. S. Reclamation Service irrigation projects, E. A. MORITZ (*Reclam. Rec. [U. S.]*, 12 (1921), No. 4, pp. 180-182).—Data from measurements of seepage losses during seven years from U. S. Reclamation Service canals are reported and discussed.

Excluding two extremely low results, the lowest indicated loss from 22 projects shows a mean of 24.3 per cent from the Tieton project, Washington. The highest loss for the period was 53.2 per cent for the Carlsbad project, New Mexico. The average loss for all the projects, exclusive of the two extremely low losses, was 36.1 per cent. From this it is considered fair to assume that 25 per cent is about the minimum loss that may safely be estimated under favorable conditions, and that 50 per cent is sufficiently high for a well-planned project under favorable conditions. The commonly accepted theory that the seepage losses from canals decrease with time is not borne out by the data presented.

Data from 277 measurements of actual and relative losses from 24 different classes of materials are also reported, showing that clay, clay loam, and gumbo

and sandy loam indicated an average loss as low as or less than that from concrete. The highest losses were indicated by gravel and sand. It is stated that the two most common methods of preventing seepage losses are lining with concrete and puddling with silt. Since concrete lining is very expensive, it should be resorted to only after all other means have failed, especially if concrete materials are not readily available.

Use of explosives in blasting stumps, G. R. BOYD (*U. S. Dept. Agr., Dept. Circ. 191 (1921), pp. 15, figs. 5*).—Semitechnical information is given covering the important details of stump-blasting operations.

The results of cooperative experiments on the use of TNT and picric acid for stump blasting, conducted by the University of Wisconsin, the U. S. Bureau of Mines, and the Department of Agriculture, are also briefly reviewed, indicating that the average charge used on 21 white-pine stumps in clay soils was 0.0274 oz. of picric acid per square inch of cross sectional area, or 0.2466 lb. per square foot.

Special attention is devoted to placing, loading, priming, tamping, and firing the charge and splitting stumps. A list of safety measures to be observed is included.

Concrete designers' manual, G. A. HOOL and C. S. WHITNEY (*New York and London: McGraw-Hill Book Co., Inc., 1921, pp. VII+276, figs. 83*).—This manual contains formulas, tables, and diagrams for the design of reinforced concrete structures, including slabs, flat slabs, rectangular beams, I-beams, columns and footings, and structures requiring shear reinforcement and subjected to bending and direct stress. Rules pertaining to design and working stresses in accordance with the Joint Committee recommendations, the American Concrete Institute recommendations, and the New York and Chicago building code requirements are included.

The disintegration of concrete in alkali soils, G. M. WILLIAMS (*Jour. Engin. Inst. Canada, 4 (1921), No. 8, pp. 446-455, figs. 8*).—A brief review and summary is given of work on the subject conducted by the Montana Experiment Station, the U. S. Bureau of Standards, the Wyoming Experiment Station, the U. S. Department of Agriculture, and the U. S. Reclamation Service. The different studies have included work both in the laboratory and field, and have dealt with all qualities of concrete and mortars exposed to a wide variety of conditions.

The laboratory studies agree that disintegration is due primarily to reaction between the salts in solution and certain constituents of the cement. Disintegration is first a chemical action which may under some conditions be accelerated by crystallization of the resulting products as well as by the alternate wetting and drying and the action of the elements.

The field investigations verify the results of the laboratory studies, and a study of the conditions indicates that the rate of disintegration is dependent upon the concentration of salt solutions, characteristics of the concrete, and exposure conditions. Sulphates appear to be the most injurious. Chlorides and carbonates are usually present, but their effect on the reactions has not been definitely established. Concrete of the highest quality, based upon present standards, has been seriously affected in waters containing high concentrations of sulphate salts. Concentrations of salts in soil water vary so greatly within short distances that the present knowledge of underground drainage conditions does not permit the drawing of definite conclusions as to the maximum concentrations which may be encountered in any locality.

The conclusive demonstration that concrete of the best quality may be disintegrated is taken to indicate that the first step of the investigation is com-

plete. The second step is considered to be the finding of some means of preventing disintegration of concrete by alkali salts other than by drainage, and is thought to be dependent upon chemical research. It is pointed out in this connection that a cementing material is needed having all the good properties and advantages of Portland cement with the additional quality of immunity to the action of alkali salts.

Prolonging the life of farm timbers, L. LEE (*N. Y. State Col. Forestry, Syracuse Univ., Circ. 34* (1921), pp. 22, figs. 5).—Practical information on the preservative treatment of farm timbers is presented in this circular. This includes descriptions of surface treating and impregnation methods.

The heat conductivity of building and insulating materials and heat permeability factors of new structures, O. KNOBLAUCH, E. RAISCH, and H. REIHER (*Gsndhts. Ingen.*, 43 (1920), No. 52, pp. 607-623, figs. 4).—In part 1 of this paper laboratory apparatus is described for determining the heat transmission coefficient of insulating and structural materials in calories per hour per degree Centigrade difference in temperature, through a cube of a material having edges 1 meter long and with four of the six faces completely protected against heat transmission. The results of tests of a number of materials are also reported.

In part 2 studies are reported with experimental buildings to determine the permeability of building materials for heat and their heat transmission coefficients. It is generally established that the heat transmission coefficient for most building and insulating materials increases with temperature, specific gravity, and moisture content. The results from the testing apparatus and from the experimental buildings corresponded closely. It is recommended that in testing damp materials the smallest possible temperature differences be used to avoid variation in moisture content during test.

Public Roads (*U. S. Dept. Agr., Public Roads*, 4 (1921), No. 5, pp. 24, figs. 12).—This number of this periodical contains the usual project statements under Federal-aid allowances approved in July, 1921, and the following articles:

Preliminary Report on the Bates Experimental Road, by C. Older and H. F. Clemmer (see below); U. S. Supreme Court Upholds State Taxation of Gasoline, by W. J. O'Leary; 9,245,195 Motor Cars and Trucks Registered First Six Months, 1921, by A. P. Anderson; Maryland's Road Accident Map Shows Great Danger of Speed, by H. D. Williar, jr.; The Field of Highway Research, by W. K. Hatt; The Need for Tree Planting Along the Public Highways, by F. W. Besley; and The Effect of Tax Limits on County and Municipal Bonds, by C. B. Masslich.

Preliminary report on the Bates experimental road, C. OLDER and H. F. CLEMMER (*U. S. Dept. Agr., Public Roads*, 4 (1921), No. 5, pp. 3-11, 22, 24, figs. 8).—The so-called Bates experimental road which has been constructed by the division of highways of the Illinois Department of Public Works and Buildings in cooperation with the Bureau of Public Roads is described.

The purposes of this experimental road are (1) to determine in so far as possible the resistance of the various kinds and types of pavements to heavy motor-truck traffic, and (2) to secure such data and information as will enable the highway engineer to attempt the design of road surfaces with some degree of confidence and accuracy. The road is laid out on a relocation $2\frac{1}{2}$ miles long. There are no curves in the alignment. The grades vary from zero to 0.4 per cent, with an average grade of 0.1 per cent, the maximum and minimum grades extending over very short distances. The subgrade soil is uniformly a brown silt loam.

The road is surfaced with seven general types of pavement, as follows: (1) Portland cement concrete, (2) 3 and 4 in. lug brick constructed monolithic with a Portland cement concrete base, (3) 3 and 4 in. lug brick constructed semimonolithic with a Portland cement concrete base, (4) 3 and 4 in. bituminous-filled lug and lugless brick on Portland cement concrete base, (5) 3 and 4 in. bituminous-filled lug and lugless brick on macadam base, (6) asphaltic concrete with and without binder course on Portland cement concrete base, and (7) asphaltic concrete with and without binder course on macadam base. The series of test sections for each type or design cover all reasonable variations in strength, and each series begins with a section roughly estimated to be equivalent in strength to 4 in. of concrete and increases to the approximate equivalent of 9 in. of concrete.

Methods of investigation and testing of surfacing materials and of the bearing power of the subgrade are also described.

New device for testing subgrade bearing power, H. F. CLEMMER (*Engin. News-Rec.*, 87 (1921), No. 11, pp. 446, 447, fig. 1).—A device to determine the action of the subgrade under hard-surfaced roads when subjected to repeated loads such as would be caused by the movement of heavy vehicles, designed by the Illinois Highway Testing Laboratory, is described and illustrated. The machine gives six loads per minute, varying from zero to maximum to zero, thus simulating the conditions imposed by a passing vehicle.

Gasoline and other motor fuels, C. ELLIS and J. V. MEIGS (*New York: D. Van Nostrand Co.*, 1921, pp. XIX+709, pl. 1, figs. 206).—The authors have endeavored to bring together in this volume such material as would constitute a substantially complete survey of the field of gasoline and motor fuels. Descriptions of practically every process of making gasoline and almost every other motor fuel of promise and prominence are included. A survey is also given of the patents which have been issued on methods for improvement in the manufacture of gasoline and in the utilization of kerosene, benzol, alcohol, and other liquid fuels.

Motor trucks on eastern farms, H. R. TOLLEY and L. M. CHURCH (*U. S. Dept. Agr., Farmers' Bul. 1201* (1921), pp. 23, figs. 10).—This is a popular discussion and analysis of data reported previously (*E. S. R.*, 44, p. 485).

Motor tractors (*Union So. Africa, Dept. Agr. Jour.*, 3 (1921), No. 1, pp. 46-60).—Tractor plowing trials conducted by the Transvaal University College are reported. The objects of the trials were to determine the efficiency of the tractors considered as plow tractors and to find the cost of plowing per acre for various types of soils and under conditions generally obtaining in the Transvaal. Each trial consisted of plowing 8 acres of virgin soil and 6 acres of old land and a brake test.

All plows were of the moldboard type. The tractors included wheel types, tracklayers, and motor plows. Thirteen machines competed, 9 being under 25 B. H. P., 3 from 25 to 30 B. H. P., and 1 over 30 B. H. P. The majority of tractors were fitted with 4-cylinder (4-stroke cycle vertical) engines, with high-tension ignition and water-cooling system of the types common in automobile practice. The type of automatic governor most in favor was the throttle governor. The oiling system for the principal bearing surfaces was in all cases either force feed or a combination force and splash feed.

The soils consisted of light sandy virgin soil well overgrown with grass, sandy loam, heavy loam, heavy virgin grassland, stiff loam, and clay loam.

On the whole the plowing was of a very high standard. From the practical point of view, however, there was a marked difference in the work done, which is attributed to inexperienced mechanics, difficulty in machine control, and unsuitable plows.

The tracklayer type of machine showed up to advantage in moving over soft ground, the large contact surface giving a better grip and causing less packing of the soil. This was especially noticeable in the cut-out where it was necessary to move over plowed land. The wheel tractors, however, moved over the soft soil quite effectively and had the advantage of less wear and tear on the wheels than on the tracks, and generally less power was absorbed by the former than by the latter. All the tracklayers moved with both tracks on the unplowed land, and the ease of steering was not affected much by any side draft. In the case of wheel tractors, improper hitching, and with small tractors unavoidable side draft, affected the control of the machine considerably. Where all four wheels moved on the unplowed ground the side draft tended to pull the front wheels into the open furrow and caused loss of power.

Tractor trials in Ceylon, 1921 (*Trop. Agr. [Ceylon]*, 57 (1921), No. 1, pp. 3-8, pls. 5).—Plowing trials of four different tractors to determine their relative merits for work upon coconut estates on the island of Ceylon are reported. Each plow was required to plow, cross plow, and disk harrow an area of 4.3 acres of old coconut soil to a depth of 6 in. and at a distance not greater than 2 ft. from the trunks of the palms. The soil was slightly undulating and ranged from gravel to sandy loam.

The largest area plowed per hour was by a 20 h. p. tractor of American make, while the lowest fuel consumption was indicated by another American tractor, which stood second with reference to area plowed per hour.

The effect of chalk on the cultivation of heavy land, E. J. RUSSELL and B. A. KEEN (*Jour. Min. Agr. [London]*, 28 (1921), No. 5, pp. 419-422).—Experiments conducted at the Rothamsted Experimental Station are reported in which soils were treated with chalk and plowed by means of tractors. The difference between the drawbar pull on chalked and unchalked soils was determined by a dynamometer. Three-furrow plows were used and the measurements recorded during cross-plowing.

Chalking not only increased the speed of plowing but considerably reduced the drawbar pull. The increase in speed in the case of one plow was from 2.18 to 2.23 miles per hour, and in the case of the other from 1.98 to 2.21 miles. The drawbar pull was reduced from 1,538 lbs. to 1,358 lbs. for three furrows with the first plow and from 1,610 to 1,425 lbs. with the second.

The average of all results indicate a saving of 180 lbs. drawbar pull and an additional mile of plowing in every nine hours of work as a consequence of chalking. These results are taken to indicate that the liming or chalking of heavy land should be regarded as one of the essential factors in the use of the tractor.

The spraying of fields with municipal sewage, M. STRELL (*Gsndhts. Ingen.*, 44 (1921), No. 22, pp. 257-262, figs. 13).—Experiments with three different types of spray irrigation apparatus to determine their usefulness in the distribution of clarified and partially clarified sewage effluent from municipal sewage disposal systems are reported.

One system is designed to aid in furrow irrigation, one simulates rain, while the other makes a strong spray. Apparently the difference is mainly one of design and arrangement of nozzle and of pressure imposed. The fields to be irrigated are laid off about 600 meters (1,968 ft.) wide with a main distribution pipe down the center with openings for lateral connections. Lateral pipes on hexagonal-shaped wheels are connected to the main pipe at the openings and may thus be moved up and down the field to the positions desired.

It is concluded that municipal sewage with a low content of suspended matter (about 1.5 cc. per liter of sewage) may be profitably disposed of on fields

with such apparatus, without any special preliminary treatment. The suspended matter should be in finely divided condition, however. Where coarse suspended matter is present preliminary screening or sedimentation is necessary. For both spray and spray-furrow irrigation a pressure of at least 3 atmospheres (about 44.1 lbs. per square inch) is considered desirable.

The well-planned kitchen (*U. S. Dept. Agr., Dept. Circ. 189 (1921), pp. 8*).—Brief and very popular information is given on the location, planning, and fitting out of the kitchen.

Floors and floor coverings (*U. S. Dept. Agr., Farmers' Bul. 1219 (1921), pp. 36, figs. 2*).—Popular information is given regarding the character and qualities of different kinds of floors and floor coverings, with particular reference to their suitability, durability, economy, and care.

RURAL ECONOMICS AND SOCIOLOGY.

Rural organization (*Natl. Country Life Conf. Proc., 3 (1920), pp. VII+242, pl. 1, figs. 2*).—The proceedings of the third National Country Life Conference held at Springfield, Mass., October 16-19, 1920, included the president's address on The Past and the Future of the Country Life Movement, by K. L. Butterfield, and papers on An American Rural Art Movement, by L. Taft; Agricultural Missions, by S. Higginbottom; The American Negro in Agriculture, by R. R. Moton; The Cooperative Movement, by W. P. Everts; Rural Organization and Rural Psychology, by E. R. Groves; Some Fundamentals of Rural Community Organization, by D. Sanderson; A Man without a Community, by H. E. Jackson; Rural Community Organization, by M. Carney; The Non-group Parts of Farm Populations, by C. J. Galpin; The Clark County Plan of Rural Organization, by R. C. Agne; Proposed Modifications and Recent Tendencies in Rural Government and Legislation, by E. H. Ryder; Rural Government and Legislation, by E. C. Branson; Recent Legislation and Facilitating Rural Community Organization, by H. P. Douglas; Organization for Rural Library Extension and for Education through the Library, by J. D. Wolcott; The Physical Aspects of the American Farm Home, by C. J. Galpin; and The Interchurch Survey, by E. de S. Brunner, together with committee reports.

Rural health (*Natl. Country Life Conf. Proc., 2 (1919), pp. 242, pl. 1, fig. 1*).—The papers and committee reports presented at the second National Country Life Conference, held in Chicago in 1919, are published here.

The country weekly in New York State, M. V. ATWOOD (*Cornell Reading Course for the Farm, No. 155 (1920), pp. 283-326, figs. 5*).—It is stated that in order to survive, the present-day village newspaper must be useful to its community. Methods of assembling and printing the newspaper, handling the advertisements, and conducting the editorial page are described. Appendixes contain statistics of the number of country weeklies in New York State and other details.

An agricultural index for farmers, F. C. BALDWIN (*Va. Agr. Col. Ext. Bul. 63 (1921), pp. 14, figs. 6*).—This bulletin describes a system devised for the convenient classification and filing of information relating to agriculture.

Agricultural economics.—Cost of production of maize, R. A. LEHFELDT (*So. African Jour. Sci., 17 (1921), No. 2, pp. 201-204*).—A few figures collected by the author in Orange Free State and Transvaal are given to illustrate methods of calculating cost of production of the South African crop and incidentally of ox labor.

Memorandum on the cost of the cultivation of rice, J. B. HARRISON and R. WARD (*Jour. Bd. Agr. Brit. Guiana, 14 (1921), No. 2, pp. 81-85*).—During the period 1913 to 1920, inclusive, detailed records of the cost of cultivating rice

were kept at the Government Botanic Gardens in British Guiana. These data are tabulated and discussed in these pages. In the summary it is stated that with high yields of about 28 bags of 140 lbs. each of paddy per acre the costs of production increased from about \$1.70 in prewar years to \$3.30 in 1920; with yields of about 22 to 24 bags per acre, from about \$2 to \$3.60 a bag; and with average yields of 18 bags per acre, from \$2.40 to \$4.60. None of these statements take into account either the costs of supervision or the interest on the constant expenditure per acre.

British Columbia dairy farm survey, H. R. HARE (*Sci. Agr.*; 1 (1921), No. 5, pp. 199-202).—In these pages is submitted a report based on a preliminary survey conducted during the summer of 1920 by the animal husbandry department of the University of British Columbia in two districts of the Fraser Valley and one on Vancouver Island. Fifty-four farms were included. Details of the business transacted during the year ended April 30, 1920, as well as an inventory of all live stock, equipment, buildings, and land, are reported.

In general, the data indicated the importance of good crops and live stock as affecting the size of the labor income, also that from the standpoint of financial returns the renters have the advantage. It seems that on farms producing few cash crops the labor income does not increase with the size of the farm. Farmers on medium-sized farms who specialized in dairying received a marked increase in labor income over the same class on small farms. Over 60 per cent of those who had large farms and specialized in dairying made practically the same labor income as did the same class on medium-sized farms. It would appear that cash crops or side lines are instrumental in raising labor incomes on farms of all sizes.

The average cost of producing butter fat on 47 farms in the districts of Chilliwack, Courtenay, and Ladner, as calculated by methods which are illustrated, was found to be \$92.97 per 100 lbs. The cost varied, however, on different farms from \$50.76 to \$193.85.

Purchasing power of the farmer (*Des Moines, Iowa: Successful Farming*, pp. 52, figs. 71).—Information relative to the comparative volume of bank deposits of farm people and of city people was reported by 325 country banks in the North Central States in answer to a brief questionnaire. It is shown that 69 per cent of the average deposits in country banks in towns of 5,000 or less comes from farmers, who carry an average balance of \$544. These farmers are cultivating land worth \$144 an acre on the average. Fifty per cent of them have credit at the bank for \$1,000 without collateral for ordinary purchases.

How farmers may form a national farm loan association (*U. S. Treas. Dept., Fed. Farm Loan Bur. Circ. 2* (1921), pp. 8).—Simple but explicit directions are offered.

Authorizing association of producers of agricultural products (*U. S. Senate, 67. Cong., 1. Sess., Subcom. of Com. Judiciary, Hearings on H. R. 2373, 1921, pp. 207*).—Statements made by representatives of agricultural producers and other farm organizations, the Secretary of Agriculture, and others at hearings before a subcommittee of the Committee on the Judiciary of the United States Senate in June, 1921, are published here.

Cooperative live-stock shipping in Iowa in 1920, E. G. NOURSE and C. W. HAMMANS (*Iowa Sta. Bul. 200* (1921), pp. 401-436, figs. 3).—Visits were made to more than 300 associations shipping live stock under cooperative arrangements in Iowa in 1920 and information was obtained from numerous other sources so that a total of 647 is noted in this bulletin. The volume of business of 342 such organizations is shown to have been 26,341 cars, 8,342 of which carried hogs, 1,838 cattle, and 162 sheep. The contents of 15,999 were not specified. Forms of organization, business methods followed, and some of the

difficulties met with are reported and discussed. Certain features which the authors deem essential in marketing mechanisms of this order are tentatively suggested.

Cooperation in Ireland, L. SMITH-GORDON and C. O'BRIEN (*Manchester, Eng.: Cooperative Union, Ltd., 1921, pp. 92, pls. 10*).—This is volume 3 in the series previously noted (*E. S. R., 43, p. 895*), and contains an account of the history, organization, and work of the cooperative movement in Ireland. Statistics illustrating the growth of the Irish Agricultural Wholesale Society, 1897–1919, are included in an appendix, and a bibliography is given.

Farm workers in Scotland in 1919–20, J. WILSON (*Edinburgh: Bd. Agr. Scotland, 1921, pp. VI+78; abs. in U. S. Dept. Labor, Bur. Labor Statis., Mo. Labor Rev., 13 (1921), No. 2, pp. 100–102*).—An inquiry into wages and conditions of labor on farms in Scotland was conducted by the Board of Agriculture by sending a small number of schedules to selected farmers in different parts of each county. The returns received cover 1,096 farms, or about 4 per cent of the number of holdings above 50 acres, and also about 4 per cent of the total number of persons returned as wage-earning farm workers in the census of 1911. They give, for each permanently employed farm worker, his or her age, cash wages, and allowance in kind.

Statements as to wages paid plowmen between 21 and 60 indicate that the average weekly earnings of both married and single men were for all Scotland \$11.96 par, which is an increase of 150 per cent over the corresponding average reported for 1907. It is said that the 9-hour day in summer and the Saturday half-holiday, except in busy seasons, has been very generally adopted, with certain exceptions. It is pointed out that the average percentage increase since July, 1914, in the cost of living of an ordinary working-class family in the United Kingdom was in June 1920, 150, in July 152, in August 155, and in September 161. Some comparative agricultural statistics for Scotland are given in appendixes.

The farmer in the commonwealth, R. H. GABRIEL (*North Amer. Rev., 213 (1921), No. 5, pp. 577–586*).—This essay treats of the agrarian movement in the United States, beginning with the passing of the frontier in the last decade of the nineteenth century and the resulting revolution in farming, elimination of the unsuccessful in the farming population, and the application of scientific principles to agriculture. Its most important phase is said to be the development of class consciousness and the organization of the modern farm group as exemplified in the farm bureau. Along with increased efficiency in production have come political influence, sanction of a farmers' lobby, consolidation of voting power, and an approach to control by this, the third economic group in the commonwealth.

Uncle Sam's free farms and ranches, C. W. SHEPARD (*Colony, Wyo.: Author, 1921, pp. [2]+18*).—Information is given covering details of homesteading Government lands under the several laws which exist regulating such disposition.

Davao: Its natural resources and opportunities for development, P. J. WESTER (*Philippine Agr. Rev., 13 (1920, No. 3, pp. 137–154, pls. 9)*).—This brief article, with maps and photographic illustrations, is descriptive of the agricultural possibilities in this Province in the Philippines.

Cotabato: Its natural resources and opportunities for development, P. J. WESTER (*Philippine Agr. Rev., 13 (1920), No. 3, pp. 155–172, pls. 6*).—This article is similar to the above in plan.

The Market Reporter (*U. S. Dept. Agr., Market Rptr., 4 (1921), Nos. 13, pp. 193–208, fig. 1; 14, pp. 209–224; 15, pp. 225–240, figs. 3; 16, pp. 241–256*).—Weekly summaries and abstracts of information covering longer periods are

given in these numbers relating to domestic movement, imports and exports, prices, the situation in the market of specified commodities and important classes of agricultural products, and of foreign market conditions. A review of the world wheat situation in 1921, contained in No. 14, gives estimates of importations of wheat by Russia and India.

Agricultural statistics of Ireland, with detailed report for the year 1917, J. HOOPER (*Ireland Dept. Agr. and Tech. Instr., Agr. Statis., 1917, pp. XVII+2-101*).—This detailed report in the series previously noted (E. S. R., 41, p. 492) furnishes particulars of the number and size of agricultural holdings, a comparative record of changes which took place over a series of years as regards extent and yields of chief crops and numbers of live stock, and other statistics, together with summary and comparative tables.

General abstracts showing the acreage under crops and the numbers and descriptions of live stock in each county and province, 1916, 1919, and 1920, J. HOOPER (*Ireland Dept. Agr. and Tech. Instr., Agr. Statis., 1920, pp. 36*).—Information previously noted (E. S. R., 44, p. 694) is continued for later years.

Area and yields of agriculture in the Republic of Austria for the year 1919, with comparisons (*Anbauflächen und Ernteergebnisse in Gebiete der Republik Österreich im Jahre 1919. Vienna: Govt., 1920, pp. 25*).—Tabulated statistics for 1919 with comparisons for 1918 and the period 1909 to 1918, inclusive, are presented, continuing the report previously noted (E. S. R., 43, p. 595).

Agrarian reforms in Czecho-Slovakia, M. MANGIN (*Jour. Agr. Prat., n. ser., 35 (1921), No. 15, pp. 290-293; also in Compt. Rend. Acad. Agr. France, 7 (1921), No. 13, pp. 332-339*).—Recent laws dealing with the breaking up of feudal estates are said to have had costly and dangerous consequences, principally in causing a loss of equipment, making necessary expensive farm construction on small holdings, materially diminishing the amount of production, and causing difficulties in forest management.

The organization of Italian commerce in agricultural products at home and abroad, G. VALENTI and G. BRIGANTI (In *L'Italia Agricola e il suo Avvenire, II. Rome: R. Accad. Lincei, Com. Sci. Aliment., 1920, pp. 223-248*).—The outline of means recommended for increasing Italian exports of agricultural products and decreasing imports, especially of industrial raw materials, includes the growing of commercial varieties, study of the markets and the tastes of foreign consumers, reduction of the cost of production to a minimum, and development of means of transportation at minimum cost with the assurance of conservation of produce in transit, prudent utilization of time and space, and the institution of commercial advisers on foreign trade.

The contribution in agricultural products by the Italian colonial possessions to the mother country, V. PEGLION (In *L'Italia Agricola e il suo Avvenire, II. Rome: Accad. Lincei, Com. Sci. Aliment., 1920, pp. 201-222*).—This paper discusses imports and exports of the Italian colonies of Eritrea, Somali, and Libia, indicating that the agricultural production is low but that much could be expected from the development of grazing, dry farming, storing of flood waters, and the developing of the principal rivers for irrigation purposes.

[Statistics relating to agriculture in Denmark, 1918-19], A. JENSEN (*Danmarks Statist. Meddel., 4. ser., 59 (1920), Nos. 1, pp. 71; 4. pp. 50*).—Statistical reports on agricultural wages in Denmark in 1918, summarized from replies to questionnaires distributed by the Statistical Department, and on the numbers of live stock on July 15, 1919, are presented in this publication, of which an earlier issue was noted (E. S. R., 44, p. 492).

Prices of grains, yields, area cultivated, and numbers of live stock in Denmark, 1919-20, A. JENSEN (*Danmarks Statist. Meddel.*, 4. ser., 60 (1921), Nos. 1, pp. 15; 2, pp. 76; 6, pp. 120).—This statistical information appears in the annual publication of which the above is an earlier issue.

[Agricultural and live-stock statistics of Finland] (*Statist. Årsbok Finland*, n. ser., 18 (1920), pp. 92-105).—These pages continue information previously noted (E. S. R., 45, p. 295).

Report of agriculture in the Netherlands in 1919, P. VAN HOEK (*Dept. Landb., Nijv. en Handel [Netherlands], Verslag. en Meded. Dir. Landb.*, No. 3 (1920), pp. LXIII+116, fig. 1).—Statistics and interpretative notes continue information as previously noted (E. S. R., 42, p. 191).

[Agricultural statistics for the Dutch Colonies, 1918] (*Jaarc. Konink. Nederlanden, Koloniën*, 1918, pp. 68-82, 162).—These agricultural statistics pertain to Java and Madura and the West Indies.

Area, classification of area, area under crops, live stock, land revenue, assessment, and transfers of land in certain Indian States, D. N. GHOSH (*India Agr. Statist.*, 34 (1917-18), II, pp. [4]+V+118, pl. 1; 35 (1918-19), II, pp. [4]+V+131, pl. 1).—These volumes continue statistics previously noted (E. S. R., 43, p. 492).

AGRICULTURAL EDUCATION.

Teaching in the small community a profession, H. A. BONE (*School News and Pract. Ed.*, 34 (1921), No. 10, pp. 616-622).—The field of rural education is said to embrace the one-room school, the one-teacher, neighborhood school, and the rural-village school, as well as consolidated and centralized schools and rural-community high schools. It is urged that teachers must be specially trained in rural sciences, including sociology, economics, nature study, physics, and others. Openings in higher supervisory teaching and administrative positions for the rural minded are also noted in this review of rural education as a profession.

The rural school situation (*Jour. Ed. [Boston]*, 93 (1921), No. 17, pp. 456-458).—District superintendents' reports covering the qualifications of 5,000 teachers in certain districts in New York State have been used as the basis of comparison between the one- and two-room schools and the three-room and village schools within the same supervisory unit.

In the one- and two-room rural schools 2 per cent of the teachers had had college or partial college work, as compared with 26 per cent in the three-room or larger graded schools. Sixty per cent of the teachers in the former had completed a four-year high school course; in the latter, 86 per cent. In the one- or two-room rural schools 7 per cent of the teachers had received professional training in normal school or in college, while in the three-room and village schools 64 per cent of the teachers had completed normal school or had had professional training in college.

The median number of years' experience for the teachers in schools of the first group was four years; in those of the second group, six years.

It is pointed out that in the smaller schools there is practically no permanency of tenure. Furthermore, the conclusion is reached that there has been a large expenditure on the per pupil basis in the smaller schools for a service that is, generally speaking, not superior.

The training of supervisors for the Maine rural schools (*School and Soc.*, 14 (1921), No. 356, p. 337).—A system of six weeks' summer normal school training for selected teachers, which provides assistants to rural superintendents, or "helping teachers," who teach regularly for observation and visit

schools to give special help in classroom organization and management, is noted here.

Rural schools for State of Delaware, J. O. BETELLE (*Amer. School Bd. Jour.*, 60 (1920), No. 5, pp. 51-55, 117, figs. 13; 62 (1921), No. 1, pp. 49-52, figs. 13).—These articles present the school building program required by the school code of the State of Delaware. Section 1 is devoted to one- and two-teacher buildings and section 2 to three- and four-teacher buildings, both being illustrated with numerous architects' drawings and floor plans.

Rural schools and teachers' houses in England, J. Y. DUNLOP (*Amer. School Bd. Jour.*, 63 (1921), No. 2, pp. 56, 57, figs. 8).—Photographs and drawings of floor plans accompany this brief article describing a one-room school, a two-room school (with teacher's house attached), and a three-room school (with the teacherage convenient).

Agricultural education for young people, F. MAT (*Rev. Gén. Agron.*, n. ser., 11 (1921), No. 3, pp. 65-79).—The system of agricultural education carried out under State supervision in Belgium includes popular courses for adults, primary professional agricultural schools, junior schools, the higher institutes of agronomy, and a few other miscellaneous schools and agricultural courses. A number of the schools are listed, together with the personnel of the teaching forces. Requirements for admission and courses offered are described.

The daily program of the one-room country school, A. J. PATTERSON (*School News and Pract. Ed.*, 34 (1921), No. 10, pp. 626-629).—A suggestion is made for a definite plan of alternation of lessons through the week, giving in detail the program as outlined.

Tests in rural schools, H. W. OERTEL (*School News and Pract. Ed.*, 34 (1921), No. 10, pp. 613-615).—This briefly discusses the functions of arithmetic, silent reading, and intelligence tests in the determination of the mentality of pupils as a basis for grading and promotion, as revealing physical condition, and as an important contribution to the teacher's definite point of view.

The place of the school farm in secondary vocational agricultural instruction, J. W. DAY (*Jour. Ed. [Boston]*, 93 (1921), No. 4, pp. 89, 90).—It is maintained that the need of the school farm has been modified by the adoption of the home-project method of teaching agriculture, and that it is no longer a necessity except in schools with a large number of boarding pupils, where it is deemed indispensable.

Status and results of county agent work, Northern and Western States, 1920, W. A. LLOYD (*U. S. Dept. Agr., Dept. Circ. 179* (1921), pp. 36, figs. 9).—A brief introductory chronicle of the beginnings and development of the work is to be found here. Its economic significance is indicated by statistics setting forth the cooperative business associations organized with the assistance of county agents and the amount of business done, 1915 to 1920, inclusive. The number of county agents is reported to have increased from 1,102 to 1,166 since March 1, 1920. The principal development in connection with county extension service is said to have been an increased emphasis on community programs. Other projects noted include soil-fertility work, work with crops, seed improvement, rodent and insect control, fruit work, live-stock work, farm management, boys' and girls' club work, and farm home work.

Status and results of home demonstration work, Northern and Western States, 1920, F. E. WARD (*U. S. Dept. Agr., Dept. Circ. 178* (1921), pp. 30, figs. 6).—The relation of the home demonstration work to the county extension organization and to the Farm Bureau Federation is briefly set forth here. The principal lines of work related to clothing, health, nutrition, home management, food production and preservation, and community enterprises. Statistics indi-

ating persons reached and adopting the practices advocated are introduced in summaries of progress in each of these lines. The specialists' part in the program of work is briefly set forth. Work with boys and girls and urban work are also noted.

Report of general activities [in cooperative extension work in agriculture and home economics] for 1920, P. H. ROLFS ET AL. (*Fla. Univ. Ext. Ann. Rpt. 1920*, pp. 115, figs. 24).—This includes reports of the director, State agent, district agents, and specialists, together with a fiscal report for the year ended June 30, 1920, setting forth the progress of extension work in Florida.

Botany, with agricultural applications, J. N. MARTIN (*New York: John Wiley & Sons, Inc.; London: Chapman & Hall, Ltd., 1920*, 2. ed., rev., pp. XII+604, figs. 490).—The most extensive changes in the preparation of this edition of the text previously noted (E. S. R., 41, p. 96) have been the addition of a chapter on variation and some changes in the presentation of heredity and evolution. The title has been changed in order to avoid the implication that a special kind of botany was being presented. The subject matter, arrangement, and presentation remain practically the same as in the first edition.

Vocational chemistry, J. J. WILLAMAN (*Philadelphia & London: J. B. Lippincott Co., 1921*, pp. IX+294, pl. 1, figs. 70).—The first 10 chapters of this book are devoted to the fundamental facts and principles of general chemistry. The other chapters are intended to supply the main chemical facts concerning plant and animal growth, embracing the composition of the soil, the chemical changes involved in its formation, the maintenance of soil fertility, the compounds of plants and the animal body, and the nutrition of animals. There are also chapters on the chemistry of cooking and cleaning and on milk and its products.

The selection of subject material was made with a view to meeting the demand for an elementary chemistry text for mixed classes in the agricultural high schools. It is designed to be the basis of a full year's course, including classroom and laboratory work.

Agriculture, O. H. BENSON and G. H. BETTS (*Indianapolis: Bobbs-Merrill Co., 1921*, spec. ed., pp. [161+444+XI+18], figs. 190).—In this special edition of an elementary text previously noted (E. S. R., 36, p. 394), the amount of teaching material on the subject of corn culture is considerably enlarged, chapters on sectional agriculture have been omitted, that on home canning is condensed, and new illustrations are added throughout.

Productive poultry husbandry, H. R. LEWIS (*Philadelphia and London: J. B. Lippincott Co., 1921*, 4. ed., rev. and enl., pp. XXII+584, pls. 2, figs. 240).—An entirely new chapter dealing with the problem of artificial illumination has been added in this, the fourth, edition of the text previously noted (E. S. R., 41, p. 597).

Clothing—choice, care, cost, M. S. WOOLMAN (*Philadelphia and London: J. B. Lippincott Co., 1920*, pp. XI+289, pl. 1, figs. 40).—Chapters are devoted to descriptions of clothing fabrics (wool, cotton, silk, and linen), and accessories of leather and rubber. The selection, repair, renovation, dyeing, and remodeling of clothing are discussed in detail, as is also the organization and function of an information bureau planned on the community basis to encourage thrift in the purchase of clothing. Suggestive outlines for instruction in high schools and in clubs and extension work are given. In the appendix are charts illustrating the making over of garments. A list of books, bulletins of agricultural colleges and farm bureaus, and other Government and miscellaneous publications is also included.

Household arithmetic, K. F. BALL and M. E. WEST (*Philadelphia and London: J. B. Lippincott Co., 1920*, pp. 271, figs. 39).—The subject matter of this

text is organized on the basis of the family budget. The first of the six sections is devoted to a study of the principles of budget making and methods of keeping simple accounts. This is followed by sections on food, shelter, clothing, operation, and higher life, respectively, the last one being devoted principally to exercises and problems in connection with savings and investment, health and health insurance, beneficence, education, and recreation.

The book is intended for use in regular arithmetic classes in the upper grades, in junior and senior high schools, night schools, technical classes, and in connection with such courses as are found in schools organized under the Smith-Hughes law. It is assumed that girls who will use it will have had preliminary training in arithmetical processes equivalent to that given in the first six or seven years of school.

The appendix presents some supplementary work in equations and proportion equations. An extensive bibliography is appended.

Spending the family income, S. A. DONHAM (*Boston: Little, Brown & Co., 1921, pp. XI+174, pls. 8*).—The approach to the problem of living on the income budget system is made here from the point of view of the individual solution of the problem, taking into consideration varying standards of saving, shelter, food, clothing, operating expenses, and development. A certain ideal percentage distribution of income is discussed as a guide. Many suggestions are made with reference to household accounting. The standard budget is illustrated by a colored graphic circle divided into five equal portions representing five divisions of expenditures, with an inner circle representing savings. Several budget plans arising from special conditions are compared with this, and reasons for variations from the standard are discussed. Chapters are devoted to the questions of individual income, the child's income, the student's income, the time budget, lists and inventories, and questions for discussion.

Recipes for instruction in domestic science (*Detroit, Mich.: Bd. Ed., 1921, pp. 72*).—This is primarily a recipe book for use in the elementary and intermediate grades in the teaching of foods and cookery. It includes, however, some facts about food, as well as the principle and method of preparing the food.

MISCELLANEOUS.

Thirty-third Annual Report of Massachusetts Station, 1920, S. B. HASKELL ET AL. (*Massachusetts Sta. Rpt. 1920, pt. 1, pp. [9]+60a*).—This contains the organization list, reports of the director and heads of departments, and a financial statement for the fiscal year ended June 30, 1920. The experimental work recorded is for the most part abstracted elsewhere in this issue.

The agricultural experiment station of Cuba, R. G. TILLERY (*La. Planter, 67 (1921), No. 15, pp. 235-237*).—This is a brief account of the functions of the station and of its several departments.

NOTES.

Alaska Stations.—Frederick E. Rader, superintendent of the Matanuska Station, died at Los Angeles, Calif., December 28, 1921. Mr. Rader was born in Ohio in 1872 and graduated from the Kansas College in 1895. In March, 1900, he was appointed assistant at the Sitka Station, and in 1904, superintendent of the Rampart Station, which he established on the north bank of the Yukon River at about 65° 30' north latitude. In 1908 he left the service and returned to California where he engaged in fruit growing for some years. When it was decided to establish an experiment station in the Matanuska Valley in 1917, he was persuaded to resume the responsibility of the pioneer work of building up a new station. He entered into the spirit of the work and not only cleared away the forest growth and erected the buildings, doing much of the manual work himself, but planned and put into execution experiments that are destined to be of great importance in the development of the agriculture of Alaska.

New Mexico College and Station.—W. A. Archer, assistant biologist, resigned September 15, 1921. J. L. Lantow, assistant professor of animal husbandry and assistant animal husbandman, has been appointed acting head of the department. Other appointments include J. H. Bardsley as station poultryman and professor of poultry husbandry; C. W. Botkin as station chemist, State chemist, and professor of chemistry; R. H. Burns as assistant animal husbandman and assistant professor of animal husbandry; W. R. Naumann, as assistant professor of biology, assistant biologist, and instructor in horticulture; and H. W. Titus as nutrition chemist, vice L. S. Brown, resigned.

Ohio State University.—C. E. Lively, instructor in sociology in the University of Minnesota, has been appointed assistant professor of rural economics. B. A. Wallace has been appointed specialist in marketing.

Pennsylvania College and Station.—Fire in the horticultural building October 28, 1921, destroyed the newly installed vitamin research laboratory and did other damage amounting to an estimated total of \$35,000.

A. J. Souba has been appointed instructor and research assistant in poultry husbandry.

Wisconsin University and Station.—At the October meeting of the Wisconsin branch of the Society of American Bacteriologists, Dean H. L. Russell was presented by his former students with a volume entitled *Papers on Bacteriology and Allied Subjects*. This memorial was given in commemoration of the twenty-fifth anniversary of his doctorate, which occurred several years ago, publication of the volume having been delayed by the war. The volume contains contributions of thirteen bacteriologists who were among the early students of Dean Russell, including E. G. Hastings, H. A. Harding, John Weinzirl, C. H. Eckles, L. A. Rogers, D. J. Davis, F. W. Bouska, J. C. Brown, E. Birge, W. D. Frost, H. A. Whittaker, A. L. Amott, and B. W. Hammer.

American Society of Agricultural Engineers.—This society held its fifteenth annual meeting at Chicago on December 27, 28, and 29, 1921.

The president's address was given by E. A. White. The main program was divided into four sub-programs corresponding to the reclamation, college, farm structures, and farm power and equipment sections of the society.

The reclamation program was opened by John Swenhardt of the Wisconsin Experiment Station with a paper on New Engineering Developments in Land Clearing Methods. This paper pointed out the functions of the engineer in land clearing projects, including matters relating to financing as well as engineering methods. The uses of explosives and of stump pullers in stump removal were discussed in particular, and illustrated by motion pictures.

A paper on Financing of Drainage Districts, by S. H. McCrory of the Bureau of Public Roads, U. S. Department of Agriculture, dealt with the legal and financial phases of drainage districts, with particular reference to selection of types of bonds, bond sales, assessments and collections, dealings with banks, and the relation of the engineer to these matters.

An illustrated lecture on Flood Control in Agriculture was presented by A. E. Morgan of Antioch College. This consisted largely of a discussion of the more important engineering and structural features of the Miami Conservancy District.

The report of the drainage committee was presented by D. Weeks and that of the irrigation committee by H. E. Murdock of the Montana Experiment Station. A paper on The Advantage of a Planned Rural Development, submitted by Dr. Elwood Mead of the University of California, was also presented.

An independent feature of the program was the report of the research and data committee, presented by R. W. Trullinger of the States Relations Service. The functions of this committee as outlined are to stimulate research in agricultural engineering and to establish standard methods of procedure for certain problems which have been shown by a committee survey throughout the United States to be of prime importance. The activities of the committee during the year included the formulation of eight projects of research with more or less standardized procedure which were presented to the society, with the recommendation that they be taken up at certain experiment stations with a view to further standardization in method of procedure. In addition a review of the history of agricultural engineering during the past 30 years was made by the committee, resulting in the conclusion that the advance in the profession has been due primarily to scientific investigation and research.

In addition to the general report a paper on Research in Agricultural Engineering was presented which consisted of a critical review of the experimentation, investigation, and research in agricultural engineering conducted during the year at State agricultural experiment stations, at other State and Federal institutions, and at some foreign agricultural institutions. A marked increase in interest in and appreciation of the importance of research in the subject was noted. As a result of this review and of the survey conducted by the committee, four general subjects were concluded to be of prime importance and worthy of immediate and exhaustive research treatment. These are in the order of their relative importance (1) power requirements of farm machinery and its more efficient utilization, (2) farm water supply and sewage disposal, (3) increase of economic efficiency of horse and mechanical power, and (4) determination of standards of design and performance for farm machines and parts thereof.

The college section program was opened by J. B. Davidson of the Iowa State College with a paper on The Organization of the College Section and Its Future Possibilities. This was followed by an open discussion on the teaching of farm drainage and irrigation, led by Q. C. Ayers of the Iowa Station, a discussion on Standardization of Loan Forms for Farm Machinery, led by D.

Scoates of the Texas Station, and a general discussion of the standardization of the term "agricultural engineering" in colleges and experiment stations.

The farm structures program was opened by F. C. Harris, who discussed Sunshine Efficiency of Hog Houses. This paper reported studies the purpose of which was to consider and investigate the methods and types of construction best adapted for obtaining sunshine in hog houses at the proper place. It was shown that the properly designed hog house running east and west will admit twice as much sunlight per square foot of glass as a house running north and south, and that the windows will be less exposed to cold winds. Better summer shade is also offered by this type of structure. It was also found that the closer the windows can be brought to the beds the greater will be their efficiencies from the standpoint of the concentration of warmth and control of the position of the sun pattern.

A paper on Some Recent Developments in Farm Buildings was presented by F. C. Fenton of the Iowa Station. This included a mathematical analysis of stresses in roofs to show the difference between ideal and actual shapes from the standpoint of strength and wind resistance. A paper on Stuccoing Farm Buildings was presented by J. E. Freeman which dealt mostly with methods. Relative Heat Conductivity of Materials Used in Farm Building Construction was the subject of a paper presented by W. A. Foster. This was a report of studies conducted at the Iowa Station on the heat losses through different materials and different combinations and thicknesses thereof, including brick, concrete, and lumber. R. L. Patty of the South Dakota Station discussed barn lot drainage and barn sanitation.

W. B. Clarkson presented a paper on Making Good Barns Better, in which ventilation and related factors were discussed. M. A. R. Kelley of the Bureau of Public Roads presented a paper on Some Problems in Barn Ventilation, which consisted of a report of studies of factors influencing ventilation in several barns in different parts of the United States. A striking feature of these studies was reverse ventilation, commonly called back draft, attributed to air elasticity under certain conditions. Other data tending partially to disprove previous findings by others were also included. A paper on the Design of Outtake Flues was presented by J. L. Strahan of the Massachusetts Agricultural College, which consisted of a mathematical discussion and analysis of factors involved in the design of outtake flues for stable ventilation. L. J. Smith of the Washington Station presented a paper describing a new system of barn ventilation. The new principle involved in this system of ventilation consists in introducing a comparatively small portion of cold dry outside air into the outtake flue, which upon warming and expanding will take up a large proportion of the moisture in the warm, moist outgoing air, thereby preventing condensation in a poor outtake flue.

H. H. Musselman of the Michigan Station discussed a Code for Country Plumbing, and E. W. Lehmann of the University of Illinois presented a paper on Keeping the Water Supply Pure. The farm structures program was concluded by a paper on Relation of Construction to Farm Building Sanitation, by C. S. Whitnah. This paper dealt primarily with factors affecting ventilation.

The farm power and equipment program was opened by a paper on the Efficient Use of Animal Power, by Wayne Dinsmore. This was an illustrated lecture in which different teams and hitches were described, varying in size from the two-horse up to the thirty and forty-horse teams. It was stated that all studies and estimates of animal efficiency in plowing should be based upon hours and miles of actually turning soil. Data were presented to show that in plowing ten hours per day better results are obtained by working two teams

each five hours a day than by working each team a full ten hours every second day. It was further pointed out that in plowing the necessity for a rest indicates a shortage of power, and that sufficient power should be added to make a rest unnecessary.

R. H. Black of the U. S. Department of Agriculture discussed the removal of dockage from wheat at the thrasher. It was stated that most of the spring-grown wheat produced in the United States comes from the States of Minnesota, North Dakota, and South Dakota. Those States have for many years produced grain containing an abnormal amount of weed seeds which is on the increase. The average dockage for the six-year period ended 1920 was 4 per cent, while for the 1920 crop alone, marketed up to January 1, 1921, the average dockage was 5.1 per cent. Samples of seed wheat taken from drills seeding fields in Minnesota and the Dakotas during the spring of 1921 showed an average of 2 per cent of weed seeds by weight, and many samples contained over 10 per cent. The 17 seeds most commonly found in wheat grown in the central northwest are wild oats, wild buckwheat, tame oats, mustard, lambs quarters, barley, green foxtail, hares' ear, flax, rye, cow cockle, pigweed, yellow foxtail, sunflower, corn cockle, wild rose, and wild peas. Experiments with so-called aspirator and disk types of cleaners for the removal of dockage at the thrasher apparently indicated the superiority of the disk types. The disk recleaner separated the grain delivered from the thrasher into cleaned grain, fine seeds, and wild oats and other coarse material. It cleaned the grain as fast as it could be fed to the separator and removed all dockage to within 1 per cent. Further studies with a view to developing this machine are to be undertaken.

A technical paper on The Coordination of Theory and Practice in the Design and Operation of Plows, with Special Regard to Their Hitch, was presented by A. C. Lindgren and O. B. Zimmerman. L. J. Fletcher of the California Station discussed factors influencing tractor design on the basis of some of the tractor studies at the station, and with particular reference to conditions in California. R. U. Blasingame of the Pennsylvania State College discussed the relation of lug equipment to traction. A review was made of studies on tractor wheel lugs and slippage, especially that conducted by the Indiana and Nebraska Stations and the Ohio State University. The results of a few studies on the shearing strengths of soils under the action of tractor lugs, made at the Pennsylvania College, were also reported, and the general conclusion drawn that little of a basic nature is known about the subject.

Reports were also received from the committees on disk harrows, left-hand plows, standards, and tractor ratings.

Officers for the ensuing year were elected as follows: President, A. J. R. Curtis; vice presidents, G. W. McCuen of Ohio State University and David Weeks; secretary, Raymond Olney; treasurer, F. P. Hanson; and members of the executive council, F. A. Wirt of the University of Arkansas, J. B. Davidson of the Iowa State College, G. W. Iverson, F. N. G. Kranich, and E. A. White.

ADDITIONAL COPIES

OF THIS PUBLICATION MAY BE PROCURED FROM
THE SUPERINTENDENT OF DOCUMENTS
GOVERNMENT PRINTING OFFICE
WASHINGTON, D. C.

AT

10 CENTS PER COPY
SUBSCRIPTION PRICE, 75 CENTS PER VOLUME

EXPERIMENT STATION RECORD.

VOL. 46.

FEBRUARY, 1922.

No. 2.

The question is sometimes raised as to the proper scope, the practicable scope, of research in the experiment stations. It comes up especially in relation to the broader ranges of higher research, and the extent to which it is feasible for individual stations to devote themselves to such inquiries beyond the special range of interest of their localities. It is a pertinent question, and it is one with which the stations have to deal sooner or later in maintaining their position and in securing appropriations.

The importance of fundamental inquiry is not directly involved in this connection, for such inquiry is now recognized as essential to advancement in sound, practical information. The point has been passed where any narrow restrictions are imposed, for the public attitude is increasingly liberal and the vision of those responsible for the stations' conduct is a natural safeguard. But many lines of investigation are very broad in their final reach, and for the good of agricultural science in general and the benefit of the stations interested in such lines, it is frequently felt desirable to follow them to the end, as far as they promise to throw light on the subject in hand. The deeper investigation penetrates, the greater the amount of activity there is in such advanced channels. Sometimes it results in a situation which, if not clarified, raises a question in the local mind.

From the first, the experiment station has been viewed as a practical institution. Its history has abundantly borne this out. The idea expressed in the Hatch Act that its work should have "due regard to the varying conditions and needs of the respective States," and that in its final outcome it is to be of practical benefit to the industry, has never been lost sight of. But in its operation it is a scientific institution, and the idea of the point at which its scientific work should begin and end has undergone steady evolution. Of necessity, it has become increasingly technical, and as such it is not as easily understood. The main interest of the public is naturally in results, but as these become more difficult to acquire in form for presentation, the process by which they are derived and the requirements on which they depend become less apparent to the public.

Experience of many years has shown that the practical problems of agriculture are not as simple as they once appeared to be. They

are complex and complicated in the extreme, and they are influenced and limited by many counteracting factors and conditions. They must be approached as are complex questions in other branches of science. The investigation must be thorough, and to make it so it is necessary to go to the root of the matter. This often leads far into the domain of special science, and requires unusual facilities and equipment. The aim is at simplicity—simplicity of the problem through differentiation, and simplicity of the answer by resolving the complexities. This is a first requirement in research, and an essential of science. It finds constantly increasing expression in agricultural investigation.

It takes a far vision to fully appreciate the necessity for such work or to judge of its ultimate importance. And the idea that the station is working not only for its own State but, to an extent, for the region in which it is located, or even the whole country, has not fully taken hold, especially where State appropriations are involved. The public needs to be carried along, to some extent, with the progress of research, in order to maintain confidence and support, and it may often be worth while to give some effort in that direction. Interest and understanding need to be cultivated. Attention to popularizing the station's work and methods, especially the reason for some of the things it does which are not so evident, may be time profitably spent.

It needs to be understood that development of intensive and far-reaching inquiry in many lines has affected the kind of facilities and the equipment necessary, making them more elaborate and of special character, and usually more expensive to install and operate. These things are reflected in the nature of the requests for funds, and unless the ultimate importance of the undertakings is made clear, the difficulty of securing the necessary funds may be serious. Special effort is required to justify such requests and to make convincingly clear the importance of inquiry whose economic bearing is, for the time being, somewhat obscure. The interdependence of the stations and other agencies for agricultural research in developing the broad basis for safe practical deductions is not always a successful argument.

Of late it would appear that there has been considerable conservatism in the matter of appropriations for advanced types of research. So far as recent increases in direct State appropriations have come they have been shared in most largely by stations whose work makes a special appeal to practice, or which have substations associated with them. Few of the stations whose programs are conspicuous for intensive research have received very substantial increases. Where there has been material increase for higher research it has come quite largely through allotment from the college or university funds,

and not through direct provision of the legislature. Still, progress is being made, and the amount of fundamental research in the experiment stations is far larger than it ever has been before.

Time was when the requirements for agricultural experimentation were comparatively simple. If the facilities were extensive it was usually in the direction of fields, orchards, farm equipment, stock, dairies, etc. The very nature of these suggested a close relation to the art; and the need for them, if not readily understood, was easily demonstrated. Gradually, however, buildings and laboratories became more elaborate, were specially provided for the station's use, and in their fittings and facilities were particularly adapted to their purposes. These changes grew out of the nature of the work, the greater specialization in agricultural inquiry and its more intensive character.

So it has come about that the modern experiment station is a quite technical institution, with much of its special equipment as far removed from the average ken as an astronomical observatory or a plant for studying geophysics. And considerable of the work of this modern plant reaches over into what a few years ago would have been thought of as quite in the field of pure science. But as all know who are familiar with the matter, the change has been in the attitude toward the problem rather than toward the industry concerned. While the idea of what is practical in agricultural research has greatly broadened, the real purpose of such research has not been lost sight of, and the change from the field to the laboratory has not had the effect of divorcing workers from interest in the practical aspects of agricultural problems.

What once seemed luxurious and elaborate in the way of facilities has become more or less commonplace, and what formerly seemed extremely technical and highly specialized for so practical an institution as an experiment station has come to lie in the very midst of its field. As examples of this more intensive inquiry it is only necessary to recall the studies in genetics, using small animals and noneconomic plants, as well as those employed in agriculture; investigations of the nutritive requirements of plants, the toxic effect of combinations, the supply at different intervals of growth, conducted by means of water, sand, or other cultures; and the relation of light intensity and other physiological factors to plant growth. Furthermore, the studies of vitamins and other food accessories with rat colonies and other small animals, the extensive work on the composition and qualities of the proteins in various foods and feeding stuffs, the life history of groups of insects, the noneconomic along with the economic species, and the description and classification of such groups of fungi as the rusts, without restriction to those known to be harmful—these illustrate the

breadth of inquiry designed to supply a broader basis of information and better facilitate economic studies and deductions.

In soil studies dependence on field experiments have given way in part to elaborate systems of lysimeters and pits at several stations, with arrangements for studying seepage, fixation, balance of materials, and change of form. In some cases the installation of these special facilities has involved an initial expense of \$10,000 to \$15,000, and led to large operating expenses because of the nature of the work. Highly complicated apparatus has been installed for maintaining desired temperatures of air and soil and bringing humidity under control, to aid in the quantitative determination of the physiological factors of plant growth; and similar provisions have been made for controlling environment in the study of plant diseases. The installation of apparatus in green houses at one of the stations to control air and soil-temperatures at will, as a means of studying the reciprocal relations of plants and disease organisms with respect to environmental conditions, has involved an outlay of some \$20,000, but has enabled work to be done which is of importance over wide sections of the country.

These facilities mark a new point of view and new methods in the study of crop factors in health and disease. The study of the flow of water and its accurate measurement, the principles of pumping machinery, etc., have necessitated the construction of hydraulic laboratories at a number of institutions far in advance of anything extant a few years ago. In animal feeding the facilities have not been confined to modern stables, spacious sheds, and paddocks for handling large numbers of animals, but special apparatus has been perfected for studying the metabolism of matter and energy, the physiology of food requirements and nutrition processes, and the basis of the theory of animal feeding.

In the interest of investigations pertaining to special industries, model working plants have been installed at several institutions. A fully equipped sugar house is maintained at one station, with technical studies of the purification and handling of juices; specially equipped creameries and cheese factories have been provided for developing the principles on which various phases of the art rests; and flour mills have been devised to determine the milling qualities of grains, with laboratories to study the causal relations between varieties, soil moisture, fertilization, etc., and the flour and bread-making qualities. One such experimental mill, recently completed in Minnesota at a cost of \$85,000, is said to be the most complete example of its kind in the world. At least one State has provided a special building and installed elaborate equipment, at a cost of fully \$70,000, for studying experimentally the handling of fruit

and fruit by-products to determine the principles underlying the practical processes of manufacture; and another State is now erecting a large and specially equipped field laboratory for some of its horticultural investigations, at a cost of more than \$250,000.

The development of these and many similar enterprises, often on an extensive scale and quite highly specialized, evidences a departure from a limited State view of problems. It expresses the idea of the mutual relationship and the interdependence of experiment stations in pushing forward the boundaries of exact knowledge. Their effort in that field, especially in the advanced ranges, is a give-and-take process, in which any one of the participants may often receive quite as much as it gives.

In a particular case a station may be exceptionally well suited to carry forward researches in a given line because of a presiding genius on its staff and special qualifications it has developed. This was illustrated, for example, in the case of the Institute of Animal Nutrition developed under Dr. H. P. Armsby, who was long regarded as the foremost expert in the country in that field. Its establishment and progress were viewed by those interested in the subject with the utmost approval and they were proud of the position the United States was able to take under his leadership. The work done was basic and related to a highly important branch of agriculture. But the support of the institute was a cause of no little concern during Dr. Armsby's life, and in the absence of an established revenue or appropriation his passing leaves a feeling of uncertainty as to the future. It has raised anew the question of how far a single State should assume responsibility for prosecuting investigations which are so fundamental and so broad in their application that they are of value to all the States.

This is not to imply that the attitude toward the Institute is anything but one of friendly appreciation or that the question of its future is governed by any narrow motives of self-interest. But if the enterprise failed to establish itself firmly and permanently when the leader was here, the burden may be the greater on those into whose keeping it has now fallen. To them not only questions of ways and means are presented, but of public policy and of the character of appeal to be made. The fact that the lines of inquiry conducted were not primarily of State interest, but were perhaps of quite as much importance to other localities, may raise the question whether continuance of such technical inquiry should not be on a broader basis of public support than that of a single State.

These, of course, are important questions, not to be settled by sentiment or by advantage to the few. The difficulty of financing the enterprise in the past increases the difficulty of planning for the

future and makes arguments of a concrete nature very important. Possibly a greater crisis in relation to the future of a line of scientific investigation of national interest has not hitherto arisen at any of our agricultural institutions. A similar situation might conceivably develop in relation to a number of enterprises of this type should a change in leadership occur. The policy and the advantage of such specialization ought, therefore, to be well defined.

It is to be remembered that agriculture has no great endowments for research. It is dependent on the appropriations of the Federal Government and the States, mostly on an annual or biennial basis. It is only, therefore, as the various States or the Federal Government take up particular lines of advanced inquiry that such special lines of investigation can be prosecuted extensively; and, as experts fully realize, it is only as such advances are made that substantial progress can be made in solving the more practical aspects of many large problems.

A point has been reached in animal feeding, for example, where research of this fundamental character is very essential. The simpler feeding experiments have been of great value up to a certain point, but they must be supported and supplemented by researches which deal with permanent factors and which throw light on the causes and reasons for the response of feed under definite circumstances. It is worth while remembering that, in this country and abroad, the investigations which have supplied the theory of feeding and the principles of nutrition have been carried on for the most part in publicly supported institutions, and not through special endowments or by workers independent of the general public for their maintenance. The same is true, of course, of practically all other branches of agriculture.

To doubt that such investigation, including that of the Institute of Animal Nutrition, has been practical would be to fail to understand how the knowledge of feeding originated which has now become general information and the basis of scientific feeding standards and methods, or how the information was derived which has made possible the applications of science to the industry of agriculture throughout its whole range. Given the facilities and equipment the institute now has for inquiry in animal nutrition, its further prosecution might not impose a burden out of proportion to what other States are doing for investigations of analogous character.

At the present stage of investigation, no experiment station can work alone and independently or solely with an eye to the benefit of its immediate constituency. It has relations to all the others, and it may be in position to render the best service in its advanced research by stressing some particular line. This represents the finest

type of correlation, and guards most effectively any possible danger of undesirable or unnecessary duplication.

In a sense, the States through their experiment stations are co-operating with one another and with the Federal Government in the advancement of knowledge. Whether or not they are working under formal agreements, they are benefiting by one another's findings and they are shaping their investigations accordingly. Some are naturally contributing more than others because they have larger resources or have been fortunate in securing investigators who have developed in special degree the qualities of leadership. Inequalities in this respect are almost inevitable, but even the smaller stations have often made contributions to the sum total quite out of proportion to their size.

Manifestly, no station ought to neglect its local problems, either practical or technical, or to stress those of primary interest outside its borders. Such a course would not be warranted by any advantage a station might possess or the special preferences of individual workers. It can not forget the immediate needs of those it is working for, and there is no indication of any danger that this will be done. But neither can it overlook the community of interest shared by members of the system; for as a matter of fact, very many of their most practical problems are fundamentally common to all or to large groups, when reduced to their simplest scientific elements. Centering attention too closely on the purely local aspects of these problems has sometimes tended to confuse their fundamental character and prevent getting at the heart of them. Divested of their local coloring and resolved into their basic elements they are seen to have much in common to be benefited by fundamental work.

After years of local experimenting, many of these matters are being viewed from a different angle, more definitely directed at the determination of underlying facts. The further progress is made in that direction and the more indispensable intensive inquiries are seen to be, the more interdependent the individual stations appear, and the more evident is their national interest in the search for truth.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

Biological analysis of the seed of the Georgia velvet bean, *Stizolobium deeringianum*, B. SURE and J. W. READ (*Jour. Agr. Research* [U. S.], 22 (1921), No. 1, pp. 5-15, figs. 15).—The experiments reported in this paper were conducted at the University of Arkansas with the hulled seed of the Georgia velvet bean (*S. deeringianum*).

When fed raw to young rats the seeds were found injurious even when constituting only 40 per cent of the total ration, thus confirming the conclusions of Miller (E. S. R., 44, p. 710) in regard to the possibility of harmful results in long continued feeding of velvet beans. Autoclaving the seeds for one hour at 15 lbs. pressure sufficiently destroyed the toxicity of the seed so that it was possible to include 60 per cent of it in the ration. On raising the amount to 80 per cent toxic effects were again evident.

As determined by the growth curves of young rats on rations containing varying amounts of the cooked navy bean supplemented in different ways, the deficiencies in the bean appeared to be chiefly in the nature of its proteins and salts. The hulled seed contained 27.5 per cent of protein and, therefore, furnished 16.5 per cent protein when fed at a 60 per cent level. This, however, proved inadequate for growth even when all of the other factors were rendered satisfactory by suitable additions. A mixture of 1 per cent sodium chlorid and 1.5 per cent calcium carbonate proved as satisfactory as the complete salt mixture, thus indicating that the calcium, sodium, and chlorin ions furnish the necessary mineral supplements.

The seeds furnished sufficient fat-soluble vitamin when fed at a level of 20 per cent of the ration. On decreasing the amount to 10 per cent growth was considerably impaired. These experiments show further the stability of the fat-soluble vitamin to heat, as the material was autoclaved for one hour at 15 lbs. pressure. The water-soluble vitamin was of low concentration. That this was not due to the removal of hulls was shown by the fact that the addition of the ground hulls in the same proportions as they occur in the whole seed did not improve the water-soluble vitamin content.

A further contribution to the study of South American oil seeds, G. T. BRAY and H. T. ISLIP (*Analyst*, 46 (1921), No. 545, pp. 325-327).—Results are reported of the examination of four species of South American oil seeds: "Cupu" seeds (*Theobroma grandiflorum*); Hymenaea fruits, probably *H. courbaril*, or locust; Parinarium seeds; and Platonía seeds. Of the four species described, cupu is the only one considered at all promising from a commercial point of view. These seeds, on extraction with petroleum ether, yield about 49 per cent of a creamy white fat of soft consistency and practically devoid of taste and odor. The analytical constants of this fat are given as follows: Melting point, 32° C.; specific gravity, 0.8522; acid value, 44; saponification value, 187.8; iodine value, 44.8 per cent; unsaponifiable matter, 0.91 per cent; and refractive index, 1.456. The residual meal contained 1 per cent of an alkaloidal substance giving the murexid reaction and which was thought to be theobromin.

Castor beans and castor oil.—**Cultural notes and the chemistry and uses of the oil**, M. RINDL (*So. African Jour. Indus.*, 4 (1921), No. 6, pp. 540-547).—This article, which forms the first installment of the nondrying oils section of the report on vegetable oils, fats, and waxes previously noted (E. S. R., 45, p. 720), deals with the cultivation, harvesting, and yield of castor beans in South Africa, and presents tabulated data on the constants of castor oil obtained from South African seeds and a discussion of the uses of castor-bean products.

Some sources of nondrying oils, M. RINDL (*So. African Jour. Indus.*, 4 (1921), No. 7, pp. 641-649).—Continuing the series noted above, similar data are presented on a number of nondrying oils obtainable from seeds and nuts common to different parts of South Africa.

The composition, solubility, and oxidation of lumbang oil, A. P. WEST and Z. MONTES (*Philippine Jour. Sci.*, 18 (1921), No. 6, pp. 619-635, pls. 3).—An analysis of lumbang oil prepared from the nuts of *Aleurites moluccana* by the method described by Aguilar (E. S. R., 42, p. 115) is reported with the following results: Linolenic glycerid, 6.56; linolic glycerid, 33.48; oleic glycerid, 56.98; and glycerids of solid acids, 2.85 per cent. The oil had a saponification value of 214, an iodine number (Hübl) of 140, and a specific gravity of 0.9206. It was insoluble at 28° C. in ethyl and methyl alcohols and acetic acid, but very soluble in cold turpentine, chloroform, ether, carbon tetrachlorid, carbon bisulphid, petroleum ether, acetone, ethyl acetate, ethylene bromid, toluene, and nitrobenzene. Determinations of the saponification and acid values and of the iodine number during oxidation of the oil gave results similar to those obtained with linseed oil, showing that the lumbang oil offers possibilities as a drying oil. Illustrations are given of the bark, flower, fruits, leaves, and seeds of the lumbang tree.

The chemical composition of peanut oil, G. S. JAMIESON, W. F. BAUGHMAN, and D. H. BRAUNS (*Jour. Amer. Chem. Soc.*, 43 (1921), No. 6, pp. 1372-1381).—A study is reported from the Bureau of Chemistry, United States Department of Agriculture, of the composition of two samples of peanut oil, one pressed from Spanish type peanuts grown in South Carolina and the other from Virginia type peanuts grown in Virginia.

The chemical and physical constants fell within the limit of those reported in the literature. The Virginia oil had a higher iodine number than the Spanish, while the iodine number of the unsaturated acids of the Virginia oil was lower than that of the unsaturated acids of the Spanish oil. The Spanish oil contained 20.6 per cent of saturated acids and the Virginia oil only 16.4 per cent. The composition of the two oils calculated as glycerids of the fatty acids was as follows: Oleic acid, Spanish type 52.9, Virginia type 60.6; linolic acid, 24.7 and 21.6; palmitic acid, 8.2 and 6.3; stearic acid, 6.2 and 4.9; arachidic acid, 4.0 and 3.3; and lignoceric acid, 3.1 and 2.6 per cent, respectively.

Refining coconut oil, A. W. KREBS (*Inst. Margarin Manfrs. Proc.*, 2 (1921), pp. 56-61).—A brief description is given of the process of refining coconut oil, including the process of hydrogenating the oil.

Investigations on the rancidity of butter and margarin fats, W. N. STOKOE (*Jour. Soc. Chem. Indus.*, 40 (1921), No. 8, pp. 75T-81T, figs. 5).—This is a general discussion, illustrated by reports of the author's investigations, of the chief factors responsible for the development of rancidity in butter and margarin fats. The various types of rancidity are classified as (1) the type characterized by a stale greasy taste and odor but with no discoloration, (2) a form of rancidity occurring frequently in margarins and characterized by a strong distinctive aromatic odor and disagreeable pungent taste, and

(3) rancidity accompanied by a marked discoloration of the butter or margarin. The first type, said to be met with chiefly in pastry margarins of high melting points, is attributed to the action of air and light, the second to species of *Penicillium* and *Aspergillus* which act particularly on coconut and palm kernel oils, and the third to color-forming molds, bacteria, and yeasts. The sources of contamination are considered to be contamination from the air, utensils, machinery, etc., from the raw materials, and from the containers and wrappers.

The behavior of pectin toward alkalis and pectase, F. TUTIN (*Biochem. Jour.*, 15 (1921), No. 4, pp. 494-497).—As the result of preliminary studies on pectin, the author reports that the actions of cold dilute alkali and of pectase on pectin are essentially identical, resulting in both cases in the formation of a salt of pectic acid and the liberation of both methyl alcohol and acetone. "This would suggest that both of them were present as ester groupings, the acetone occurring as an ester of its enolic modification, isopropenyl alcohol, $\text{CH}_3\text{C}(\text{OH}) : \text{CH}_2$. It appears likely, therefore, that pectin is the dimethylisopropenyl ester of pectic acid."

The pectin used in the investigation was prepared from apple pomace by precipitation with alcohol from a water solution, and was purified first by solution in water and reprecipitation, and further, by re-solution, treatment with animal charcoal, and subsequent precipitation with alcohol.

On an autoxidizable constituent of the cell, F. G. HOPKINS (*Biochem. Jour.*, 15 (1921), No. 2, pp. 286-305).—The author describes the isolation from yeast, from muscle, and from mammalian liver of a substance responsible for the nitroprussid reaction which is given by nearly all animal tissues.

"Evidence is given to show that the substance is a dipeptid containing glutamic acid and cystein. The relation of the two amino acids in the molecule has not yet been determined. Though present in low concentration (0.01 to 0.02 per cent of the fresh tissue) the dipeptid contains practically the whole of the nonprotein organically bound sulphur of the cell.

"The substance is autoxidizable, and, owing to the changes in the sulphur group of its cystein moiety from the sulphhydryl to the disulphid condition and vice versa, it acts readily under varying conditions either as a hydrogen acceptor or an oxygen acceptor (hydrogen 'donator'). It can be both reduced and oxidized under the influence of factors shown to be present in the tissues themselves.

"Evidence is discussed which suggests that the substance has actual functions in the chemical dynamics of the cells."

Color standards for the colorimetric measurement of H-ion concentration, L. J. GILLESPIE (*Jour. Bact.*, 6 (1921), No. 4, pp. 399-405, fig. 1).—This paper consists of a criticism of the data presented by Medalia (*E. S. R.*, 44, p. 411) which are not in accord with the results obtained by the author in developing a similar system of color standards. The plan on which the proposed tables of Medalia are based is thought to lack a solid foundation and to be supported by too few data. As a further contribution to the subject of the previous paper a colorimeter for two-colored indicators is described which, with slight modifications, can be used to determine both the percentages and the total concentration of the two colors present.

Notes on the measurement of H-ion concentration, G. W. MONIER-WILLIAMS (*Analyst*, 46 (1921), No. 545, pp. 315-324, figs. 4).—A simple apparatus for determining H-ion concentration electrometrically by measuring potential difference by the so-called compensation method of Poggendorf is described and illustrated, and the application and limitations of the method are discussed.

Introduction to qualitative chemical analysis, T. W. FRESSENIUS, trans. by C. A. MITCHELL (London: J. & A. Churchill, 1921, 17. ed., rev. and enl., pp. XX+954, pl. 1, figs. 57).—This is an English translation of the seventeenth edition of this standard German work on qualitative analysis.

Distillation apparatus, P. GROSS and A. H. WRIGHT (*Jour. Indus. and Engin. Chem.*, 13 (1921), No. 8, pp. 701–703, figs. 6).—Several ingenious pieces of apparatus are described and illustrated, including a simple fractionating column and device for the protection of corks against the solvent action of vapors, a micro-distilling flask and receiver for vacuum fractionations, and a vacuum gage.

A new type of sodium lamp for polarimetry, H. A. FALES and J. C. MORRELL (*Jour. Amer. Chem. Soc.*, 43 (1921), No. 7, pp. 1629, 1630, fig. 1).—In the lamp described the authors use an alundum thimble or crucible as a reservoir for the salt, preferably sodium chlorid. When the thimble is heated in the flame of a Meker burner the sodium chlorid melts, flows through the pores of the thimble, and is vaporized so as to give a very intense illumination.

The measurement of color, C. E. K. MEES (*Jour. Indus. and Engin. Chem.*, 13 (1921), No. 8, pp. 729–731, figs. 6).—Brief descriptions are given of several types of apparatus used for color measurements, including the spectroscope, spectrophotometer, and three types of colorimeters—the monochromatic analyzer, a trichromatic analyzer, and a third type designed by L. A. Jones of the laboratories of the Eastman Kodak Company. This colorimeter is based upon the subtractive principle, depending upon the use of colored wedges, each wedge absorbing one-third of the spectrum. When the wedges are placed over each other in pairs they will give any color possible, provided the intensity is adjusted at the same time by means of a fourth neutral gray wedge.

Method of measuring the opacity of liquids, J. HOLKER (*Biochem. Jour.*, 15 (1921), No. 2, pp. 216–225, figs. 3).—The author describes an opacimeter or apparatus for determining the opacity of liquids. This consists of a tube of resistance glass about 250 mm. long and 20 mm. wide, flattened at the bottom and provided about 20 mm. from the bottom with a narrow outlet tube fitted with a stopcock. Across the bottom of the tube is fastened by two pieces of plasticine a fine copper wire blackened by passing through a flame. If the tube is filled with a turbid liquid the wire at the bottom is not visible until some of the liquid has been drawn off. The reciprocal of the depth of the liquid remaining, as measured on the millimeter scale etched on the tube, is taken as the measure of the opacity of the liquid. The apparatus with methods of illumination and with modifications applicable to work on a small scale is described in detail, and its operations and limits of accuracy are discussed.

The determination of small quantities of zinc, M. BODANSKY (*Jour. Indus. and Engin. Chem.*, 13 (1921), No. 8, pp. 696, 697).—The author has found that in the presence of calcium citrate the tendency of zinc sulphid to form colloidal suspensions when precipitated from acid and even from alkali solutions is avoided, and a more complete recovery of minute quantities of zinc is possible. This discovery has been applied to the turbidimetric method of Breyer as developed by Birckner (*E. S. R.*, 41, p. 464), the modified procedure being as follows:

The weighed material is oxidized with sulphuric acid followed by nitric acid, ashed, and the ash extracted repeatedly with hot dilute hydrochloric acid. The combined filtrates are evaporated to dryness, the residue is dissolved in 2 cc. of concentrated hydrochloric acid and 50 cc. of distilled water, and the copper precipitated as the sulphid and removed by filtration. The filtrate, after the hydrogen sulphid had been expelled by boiling, is cooled, neutralized

with ammonium hydroxid, and treated with 10 cc. of 50 per cent citric acid. The solution is again heated to boiling, and small quantities of calcium carbonate are added until a precipitate of about 1 gm. of calcium citrate is formed. A rapid stream of hydrogen sulphid is then passed through the liquid until the latter has cooled. The flask is allowed to stand for several hours until the supernatant liquid is clear. The precipitate is then collected on the filter, washed with 2 per cent ammonium thiocyanate, and dissolved on the filter paper with hot dilute hydrochloric acid. If clear and colorless, the solution is ready for the turbidimetric comparison by the usual technique.

A method of estimating phenylhydrazin volumetrically and its application to the estimation of pentosans and pentoses, A. R. LING and D. R. NANJ1 (*Biochem. Jour.*, 15 (1921), No. 4, pp. 466-468).—The method described consists essentially in distilling the substance with dilute hydrochloric acid, neutralizing with sodium hydroxid, acidifying slightly with acetic acid, precipitating the hydrazone with phenylhydrazin, and determining the excess of phenylhydrazin in an aliquot of the filtrate iodometrically. Results obtained with a sample of arabinose agree closely with those obtained by the phloroglucinol method.

On the stability of tryptophan in baryta hydrolysis, H. ONSLOW (*Biochem. Jour.*, 15 (1921), No. 3, pp. 383-391).—In this and the following paper are reported the results of attempts to obtain a satisfactory method of determining tryptophan.

In the hydrolysis of caseinogen in acid solution or in a solution made alkaline by sodium hydroxid, tryptophan was easily destroyed, but when barium hydroxid was used the tryptophan was much more stable. On the other hand tryptophan alone proved more stable when boiled in acid than in alkaline solution. Of the alkalis barium hydroxid proved less destructive than sodium hydroxid or sodium carbonate. The less rapid destruction of tryptophan in the hydrolysis products of caseinogen by barium hydroxid is attributed to the presence of other products of hydrolysis. This was confirmed by boiling a mixture of known amounts of tryptophan and other amino acids with barium hydroxid, precipitating with the mercury reagent, and estimating the tryptophan from the amino nitrogen.

It was found possible to prevent to a great extent the precipitation of the tyrosin by the mercury reagent by raising the concentration of the sulphuric acid to 7 per cent by volume. At this concentration cystin is not precipitated, while histidin is precipitated unless its concentration is reduced to 0.02 per cent. The amount of tryptophan recovered by this method was more than that originally used, thus showing that the method brings down other amino acids with the tryptophan.

On the nature of the substances precipitated by mercuric sulphate from hydrolyzed caseinogen, with reference to the estimation and isolation of tryptophan, H. ONSLOW (*Biochem. Jour.*, 15 (1921), No. 3, pp. 392-399).—A further study of the mercuric sulphate compound precipitated from hydrolyzed casein, as above, has led to the identification of the following amino acids: Leucin, cystin, traces of tyrosin and other monamino acids, glutamic and aspartic acids, histidin, and a little prolin, but neither lysin nor arginin.

The method finally adopted as most satisfactory for determining tryptophan consists essentially in digesting the caseinogen with trypsin in a buffer solution to prevent the rise of H-ion concentration due to the liberation of the amino acids, precipitating with the mercuric sulphate reagent, decomposing the precipitate with hydrogen sulphid, and digesting with trypsin a second time, after which the butyl alcohol extraction method of Dakin (*E. S. R.*, 40, p. 611)

is followed. This procedure, the technique of which is described in detail, is said to result in a yield of tryptophan comparing favorably with that obtained by Dakin.

Imitation fruit juice beverages, W. W. SKINNER (*Amer. Food Jour.*, 16 (1921), No. 7, pp. 13, 14).—This is a discussion of Federal regulations governing the manufacture, labeling, and sale of imitation fruit juice beverages.

Dairy chemistry: A practical handbook for dairy chemists and others having control of dairies, H. D. RICHMOND (*London: Charles Griffin & Co., Ltd.*, 1920, 3. ed., rev., pp. XII+490, figs. 53).—In preparing the third edition of this handbook on dairy chemistry (E. S. R., 32, p. 501), the subject matter has been rearranged into three parts as follows: The constituents of milk, the analysis of milk and milk products, and technical applications. In addition to the new material incorporated in the various sections, the results of researches appearing while the work was in press have been included as addenda. The revised tables of statistical matter have been incorporated in the text instead of being issued as an appendix.

Methods of examining milk and dairy products, C. BARTHEL (*Die Methoden zur Untersuchung von Milch und Molkereiprodukten*. Berlin: Paul Parey, 1920, 3. ed., rev. and enl., pp. VIII+296, figs. 72).—The previous edition of this laboratory manual for dairy chemists (E. S. R., 26, p. 111) has been thoroughly revised and considerably enlarged.

The rare sugars: Their purity and tests, C. PFANSTIEHL and R. S. BLACK (*Jour. Indus. and Engin. Chem.*, 13 (1921), No. 8, pp. 685-687).—The authors outline briefly the standards of purity for the rare sugars, general tests for purity applicable to all sugars, and specific tests for individual sugars.

The standarization of rare sugars, H. T. GRABER (*Jour. Indus. and Engin. Chem.*, 13 (1921), No. 8, pp. 687, 688).—A routine analytical procedure for the standardization of rare sugars is described briefly, and a few special tests for individual sugars are outlined.

The examination of sugar crystals by projection, G. P. MEADE (*Jour. Indus. and Engin. Chem.*, 13 (1921), No. 8, p. 712).—The author suggests the use of a balopticon for measuring the size and regularity of sugar crystals in raw sugar examination, and describes a technique of comparison which has proved satisfactory.

Conditions affecting the quantitative determination of reducing sugars by Fehling solution.—Elimination of certain errors involved in current methods, F. A. QUISUMBING and A. W. THOMAS (*Jour. Amer. Chem. Soc.*, 43 (1921), No. 7, pp. 1503-1526, figs. 7).—This paper reports the results of an exhaustive study of the errors involved in the analysis of reducing sugars by the Fehling method and its modifications, the purpose of the investigation being "to establish conditions for the use of a Fehling solution in the quantitative analysis of common sugars such that the errors due to atmospheric pressure fluctuations and temperature of digestion, difficulty in observation of exact time of boiling, surface oxidation, auto-reduction of Fehling solution, and reducing action of sucrose might be eliminated or reduced to a minimum."

As the result of this investigation a method is proposed which has been found to give results of a much higher degree of accuracy than the current methods of sugar analysis. The paper should be consulted in the original for the details of the modified technique, which must be followed exactly to obtain accurate results.

The estimation of nonprotein nitrogen in blood by a micro-Kjeldahl method, E. L. KENNAWAY (*Biochem. Jour.*, 15 (1921), No. 4, pp. 510-512, fig. 1).—The essential features of the technique described for the micro-

Kjeldahl method of determining nonprotein nitrogen are the use of a bath of molten metal for finishing the combustion of the material and the use of aspiration to add the alkali to the acid solution after combustion. The method is described in detail, with illustration of the apparatus employed.

Rules for the analysis of chemicals used for the preparation of rubber (*Arch. Rubbercult. Nederland. Indië*, 4 (1920), No. 7, pp. 347-349, 351-353).—Directions are given for the analysis of sodium bisulphite, sodium sulphite, sodium carbonate, formalin, and acetic acid, the methods described being those adopted as official for the rubber experiment stations in the Dutch East Indies.

The determination of available calcium oxid in lime used for unhairing hides, F. P. VEITCH and T. D. JARRELL (*Jour. Amer. Leather Chem. Assoc.*, 16 (1921), No. 8, pp. 438-444).

Notes on water extraction of leather, F. P. VEITCH and R. W. FREY (*Jour. Amer. Leather Chem. Assoc.*, 16 (1921), No. 9, pp. 491-510).

Extraction of oil and greases from leather, F. P. VEITCH and I. D. CLARKE (*Jour. Amer. Leather Chem. Assoc.*, 16 (1921), No. 9, pp. 458-477).

Beeswax (*Min. Agr. and Fisheries [London], Leaflet 378* (1921), pp. 4, pl. 1).—This leaflet contains brief directions for the extraction of beeswax by the so-called solar wax extractor, steam, boiling water, and the heat of the oven. The first method, which is considered the most efficient and economical, requires a simple apparatus which is essentially a miniature garden frame with a double-hinged glass cover. Inside, the frame is fitted with a metal tray which slopes down to a tin trough covered with wire gauze. The wax to be recovered is spread on the tray, the cover is shut, and the apparatus placed in a sunny position. The wax then melts and runs into the trough and the impurities remain on the screen.

The physical characteristics of pure beeswax and simple tests for detecting adulteration are included.

The preservation of tropical fruits, P. J. WESTER (*Philippine Agr. Rev.*, 13 (1920), No. 3, pp. 173-185, pls. 4).—This article includes suggestions for the possible commercial development of the manufacture of preserves from tropical fruits in the Philippines, descriptions for the fruits suitable for preserving, and recipes for the preparation of jams, jellies, and preserves from these fruits. Illustrations are given of the fruits described.

Wood waste, I. H. BOAS (*Aust. Inst. Sci. and Indus. Bul.* 19 (1921), pp. 82, figs. 10).—This publication contains an outline of methods used in different countries for the utilization of wood waste, with details regarding wood distillation and the manufacture of industrial alcohol. A bibliography of 38 titles is appended.

METEOROLOGY.

Intercontinental problems in bioclimatics, with special reference to natural and artificial distribution of plants and animals, A. D. HOPKINS (*Jour. Wash. Acad. Sci.*, 11 (1921), No. 10, pp. 223-227).—This article discusses some of the basic principles of the bioclimatic law enunciated by the author (*E. S. R.*, 41, p. 16), as well as methods and results of the application of the law in a study "of the relations between the advance of spring in eastern North America and western Europe as based on certain phenological events that characterize a particular phase of such advance." The results of predictions from records at an intercontinental base station at Kanawha Farms, W. Va., for places in western Europe "leave little or no reasonable doubt," in the mind of the author, "as to the fact of, and prevailing responses represented by, the bioclimatic law. Neither should there be any doubt as to its practical applica-

tion to almost any problem in any branch of natural science which involves a consideration of the responses of living organisms and climatic elements to continental, regional, and local influences, or to problems that require a measure of the relative intensity of the factors of variations as related to periodical manifestations and geographical distributions."

Influence of climate on the yield and quality of sugar beet in Canada, E. G. McDOUGALL (*Canada Bur. Statis., Mo. Bul. Agr. Statis., 13 (1920), No. 146, pp. 295-301; abs. in U. S. Mo. Weather Rev., 49 (1921), No. 7, p. 395*).—The author attempts to correlate experimental data relating to percentages of sugar and solids in the juice, and the coefficient of purity and the yield per acre of sugar beets, with the weather factors during the growing season, for 18 successive years.

"The correlations between the percentage of sugar and the weather factors are decidedly small, but the coefficient of purity (the percentage of sugar in the dissolved solids) is more significantly related to weather conditions, having its highest correlation (a positive one) with the mean minimum temperature for the season. The yield shows a positive relation with both maximum and minimum temperatures, and most significantly with the mean temperature for the season. It has a high positive correlation with the relative humidity, and an unexpected low one with the rainfall. . . .

"The yield is closely related to the mean temperature, and, in a less degree, to the mean relative humidity of the growing season. Conditions are favorable when the mean temperature exceeds 60° F. and the relative humidity exceeds 80 per cent. They are unfavorable when the temperature falls below 55° and the relative humidity below 70 per cent. Within ordinary limits the yield is not very greatly affected by the rainfall, provided the crop is thoroughly cultivated. In semiarid regions irrigation increases the yield without impairing the quality. The quality of the beets depends chiefly on the night temperatures; the sugar content and purity decline when the mean temperature for the season falls below 45°."

Monthly Weather Review (*U. S. Mo. Weather Rev., 49 (1921), Nos. 7, pp. 379-433, pls. 11, figs. 16; 8, pp. 435-479, pls. 11, figs. 26*).—In addition to detailed summaries of meteorological, climatological, and seismological data and weather conditions for July and August, 1921, and bibliographical information, reprints, reviews, abstracts, and minor notes, these numbers contain the following contributions:

No. 7.—Improved Gages for Precipitation (illus.), by S. P. Fergusson; A Warm Winter (1920-21) Followed by a Warm Summer, by A. J. Henry; The Earth's Windbelts as Factors of Climate, by L. W. C. Bonacina; Concerning a Graphical Device for Pressure Reduction (illus.), by C. L. Meisinger; Note on Thunderstorm Breeding Spots, by B. M. Varney; The Distribution of Rainfall Over Restricted Areas (illus.), by A. J. Henry; Substances Dissolved in Rain and Snow, by S. Shaffer (see p. 116); Remarkable Aurora of May 14-15, 1921, by H. Lyman; Waterspouts on Lake Ontario, by E. Gay; and Another Observation of Waterspouts, by H. B. Benedict.

No. 8.—Excessive Precipitation in Arkansas (illus.), by H. S. Cole; Relation between Frequency and Intensity of Precipitation (illus.), by J. W. Alvord; Sources of Two Unusual Rainfall Records, by I. E. Houk; Early Records of Tropical Hurricanes on the Texas Coast in the Vicinity of Galveston, by R. D. Frazier; Systematic Corrections to the Calama, Chile, Solar Constant Values, by C. G. Abbot; and Supplemental Note on Free-air Temperature at Drexel and Ellendale during the Warm Summer of 1921, by A. J. Henry.

Weather on a New England farm, M. FAGERSTROM (*Bul. Amer. Met. Soc.*, 2 (1921), No. 9, pp. 115-117).—In this article the vicissitudes and uncertainties of New England weather, especially as related to farm life and activities, are entertainingly and instructively set forth by "one born and brought up on a New England farm."

Substances dissolved in rain and snow, S. SHAFFER (*U. S. Mo. Weather Rev.*, 49 (1921), No. 7, pp. 404, 405).—Analyses of 45 samples of rain and snow collected at Mount Vernon, Iowa, during the period from August 18, 1920, to June 1, 1921, are reported.

The total precipitation for the period was 20.97 in., 18.14 in. being in the form of rain and the remainder in the form of snow. The total nitrogen brought down by the rain and snow was 3.28 lbs. per acre, of which 1.48 lbs. was free ammonia, 1.16 lbs. albuminoid ammonia, 0.6 lb. nitric nitrogen, and 0.04 lb. nitrous nitrogen.

"On the whole, no difference was found in the amounts of substances dissolved by snow and by rain under the same circumstances. . . . [There was] a very striking increase of ammonia with increase of interval. The albuminoid ammonia remained on the average fairly constant throughout the year, as did the free ammonia. Both were lower in the spring than during the fall and winter."

"There was no noticeable variation of the amount of nitrates with the seasons. On the contrary, the average through the year was quite constant. When the amount of nitrate per inch of rain for each month is compared with the rainfall in inches for each month, it is found that the nitrates are greater when the rainfall is less—that is, the solution is more concentrated, as might be expected. . . . The nitrites, like the nitrates, tended to greater concentration, when there was less rain, but this tendency was not so marked as in the case of the nitrates. . . .

"A total of 34.43 lbs. of chlorids per acre was found. The average chlorin content was 10.1 parts per million. The highest was 49.7 parts per million. The chlorids were higher during the winter and spring than during the fall. They were not found to be present in constant proportion as was reported by former investigators, but varied from 3.5 parts per million to 49.7. The chlorids show the same tendency as the other substances to be more concentrated when the rainfall is less. A curve between chlorids and intervals of time shows a tendency toward increase in chlorids with increase in time interval.

"The total sulphates amounted to 327.06 lbs. per acre, figured as SO_3 . The average was 29.9 parts per million, and the highest 101.2, on May 17, 1921. The sulphates undoubtedly come from the combustion of the sulphur in coal used for heating."

SOILS—FERTILIZERS.

Studies in soil moisture, I. B. H. WILSDON (*India Dept. Agr. Mem., Chem. Ser.*, 6 (1921), No. 3, pp. 155-186, pls. 5, figs. 6).—This report is a preliminary account of the lines of work on the subject of soil moisture which have been developed by the Agricultural Research Institute at Pusa since 1917.

The importance of studying all the factors affecting the movement of water in the soil, and particularly of the salts contained in irrigation water, is pointed out. From an approximate calculation an estimate can be formed of the amount of water percolating from an irrigation area. Applying this to the irrigated fields of the Lower Chenab Canal colony it is estimated that the subsoil losses represent 38 per cent of the water taken in at the headworks. The gross area commanded by the canal is 3,360,000 acres, and the total per-

colation is said to be in the neighborhood of 3,255 sec.-ft. Of the total loss 17.5 per cent is lost by absorption in the main line and branches, leaving about 20 per cent to be accounted for by loss from distributaries, water courses, and fields.

The average of a large number of analyses of irrigation water made at the station showed that the total content of soluble matter is about 12 parts per 100,000, and is composed almost entirely of the sulphate, chlorid, and carbonate of sodium. It is estimated that about 337,000 tons of sodium salts are added annually to the 2,258,000 acres of actually irrigated land in the colony, or from 0.1 to 0.2 ton per acre. The total amount of sodium salts percolating to the subsoil is estimated on the assumption that the subsoil water contains 20 parts of sodium salts per 100,000 and the irrigation water 10 parts.

On the basis of thermodynamical considerations, theoretical relations determining the equilibrium of a so-called free solution, having an osmotic pressure with the water bound in the colloid phase and the vapor phase, are deduced. From consideration of surface tension, a relation is deduced between the average size of soil particles and the film tension of water in the soil at various concentrations, by means of which it is possible to calculate the statical distribution of water in a column of soil saturated at its base. The relation of these deductions to the empirical soil constants is discussed, and a satisfactory result is obtained for the calculation of the moisture-holding capacity of soils.

Experimental results are given showing the variation of bound water in the colloid of a soil with the osmotic pressure of the solution. Extrapolation to zero osmotic pressure gives a value for the moisture absorbed by the colloid which is 4.7 times the hygroscopic coefficient. On the basis of these results an explanation of the empirical relationship between the moisture-holding capacity of a soil and its hygroscopic coefficient is afforded. It is suggested that the bound water of the soil exists in two phases, which have been provisionally named "gel" water and vesicular water.

A preliminary experimental investigation of the compressibility of soils is described, but the results so far obtained do not allow of any deductions being made as to the swelling pressure of the soil colloids, for which purpose it was intended. Experiments are described in which the hydrostatic pressure due to film tension is balanced against the osmotic pressure of a soil solution.

The following tentative conclusions bearing on the composition of the solution draining from soils and on the economic use of water are drawn: "In the case of a soil containing no colloid, such as a coarse sand, the behavior of the soil solution will be determined completely by the average size of the particles and the surface tension of the solution. The composition of the solution draining from such a soil should, therefore, remain unaltered. If, however, a saline water is added to a soil containing colloid, water will tend to move through the colloid phase in order to dilute the solution if its osmotic pressure is greater than the swelling pressure of the colloid, or the solution will become more concentrated if the reverse is the case. . . . It thus appears that the first action is for free water to move across to the salt layer in order to dilute the solution, thus reducing the osmotic pressure and increasing the hydrostatic pressure on the water side. The salt then diffuses back, carrying with it water. The final equilibrium will thus be obtained, in the absence of a semipermeable membrane, when the salt solution is equally distributed throughout, but the rate at which the salt solution will move back may be very slow.

"Since the equilibrium distribution of water in a soil is determined by the vapor pressure gradients in the soil atmosphere, the 'bound' water of the colloid will have a definite value at equilibrium at each point in the column; the

concentration of the subsoil water will therefore affect the 'capillary' rise, whereas, in the case of a sand, it will only do so in virtue of its concomitant variations in surface tension. Since, therefore, the solution draining from a soil may be supposed to be in virtual osmotic equilibrium with the colloid at each point, the composition of the solution will be determined by the colloid content. We should expect, therefore, that the ground water beneath a heavy soil would be more saline than in the case of a light soil.

"Again, the rate of movement of a soil solution in a sandy soil should depend only on the gradient of hydrostatic pressure due to film tension and the viscosity of the solution. In the case of a soil containing colloids, however, we have two rates to consider—the rate of movement of water in the colloid phase and also the rate of movement of the free solution in virtue of its hydrostatic pressure.

"The importance of considerations such as these in determining the advisability of shallow and frequent or heavy and infrequent irrigations need not be emphasized. It would appear that in a light soil where the composition of the drainage water is unaffected, water economy should demand light and frequent waterings. In the case of a heavy soil, however, owing to the possibility of the concentration of the soluble matter of the irrigation water by virtue of a rate of diffusion of the water through the colloid phase to drier parts of the soil, greater than that of the free solution, the soil may become saline; heavy waterings, therefore, seem indicated. Moreover, although in such a soil, the water may penetrate beyond root range, it will still be available to some extent to the crop by upward movement through the colloid phase without carrying up salt."

Soil acidity and bacterial activity, R. E. STEPHENSON (*Soil Sci.*, 12 (1921), No. 2, pp. 133-144).—A continuation of studies conducted at the Iowa Experiment Station, to determine the influence of the decomposition of farm manure, cottonseed meal, horse manure, timothy hay, clover hay, green timothy, and green clover on the reaction of heavy silt loam soil and sandy soil, both low in organic matter, and a loam soil rather high in organic matter, are reported (*E. S. R.*, 41, p. 319; 42, p. 423).

It was found that the lime requirement of none of the soils was increased by the organic treatments except in those cases where there was a large production of nitric acid. Ammonification was apparently greater in the absence of lime. Lime generally stimulated nitrification. The sum of ammonia and nitrates was usually greater on the unlimed soil when treated with nitrogenous organic materials. When nitrogenous sources of energy such as horse manure and timothy hay were supplied, nitrification and ammonification were reduced below that of the untreated soil. The green materials were somewhat more readily attacked than the dried materials.

The soluble unknown nonprotein nitrogen, determined at the second sampling on the more fertile soil when the activity of the organisms was nearly at a maximum, showed little effect due to the various organic treatments. The cottonseed meal was the only treatment which gave any large increase over the untreated soil. In all cases but one the unlimed treatments gave a higher nonprotein nitrogen content than the limed.

Soil survey of Adair County, Iowa, C. LOUNSBURY ET AL. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils*, 1919, pp. 25, fig. 1, map 1).—This survey, made in cooperation with the Iowa Experiment Station, deals with the soils of an area of 366,720 acres in southwestern Iowa, which is situated on the watershed separating the tributaries of the Missouri from those of the Des Moines River. The area has a generally rolling surface with sharply rolling to broken belts along some of the larger streams. The drainage is carried mainly by the Middle River in the northeastern part and by branches of the Nodaway River

in the western and southwestern parts. The branching tributaries of streams are said to reach practically all parts of the county.

The great mass of the soil material is of glacial origin, over parts of which rests a mantle of loess. The soils are of loessial, glacial drift, and stream-laid origin. The loessial soils occupy the more elevated land surfaces. Eight soil types of 7 series are mapped, of which the Tama silt loam and Shelby loam cover 50.4 and 36.4 per cent of the area, respectively.

Soil survey of Chariton County, Mo., W. I. WATKINS ET AL. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1918, pp. 34, fig. 1, map 1*).—This survey, made in cooperation with the Missouri Experiment Station, deals with the soils of an area of 483,840 acres in north-central Missouri, the topography of which varies from comparatively level to steeply rolling. The upland consists of an eroded plain bordered on the south and west sides by broad belts of alluvial land. The upland ranges from undulating to sharply rolling, and consists mainly of long ridges separated by nearly parallel valleys. The stream valleys are broad and flat, and consist of the flood plains of the large streams now subject to overflow and of terraces above high water mark.

The county is said to be on the whole well drained, although the sluggish currents and tortuous courses of the streams cause them to overflow easily.

The soils of the county are of loessial, glacial, and alluvial origin. The loessial soils cover the greater part of the upland. Including riverwash, 24 soil types of 15 series are mapped, of which the Shelby loam, Grundy silt loam, Wabash clay, and Wabash silt loam cover 16.4, 16.2, 12.5, and 11.1 per cent of the area, respectively.

Soil survey of Meigs County, Tenn., A. T. SWEET and J. H. AGEE (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1919, pp. 38, fig. 1, map 1*).—This survey, made in cooperation with the Tennessee Geological Survey, deals with the soils of an area of 135,040 acres in eastern Tennessee, which occupies a part of the Great Appalachian Valley. The topography consists of narrow parallel ridges and valleys with a northeast-southwest trend. The area is said to be well drained.

The soils of the upland are residual in origin and of the river and stream valleys of alluvial origin. Including rough stony land, 15 soil types of 11 series are mapped, of which the Frederick gravelly loam covers 30.9 per cent of the area.

Soil survey of Freestone County, Tex., H. W. HAWKER ET AL. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1918, pp. 58, fig. 1, map 1*).—This survey, made in cooperation with the Texas Experiment Station, deals with the soils of an area of 557,440 acres in east-central Texas, the greater part of which consists of Coastal Plain upland. The topography in general is that of a smooth, even plain, with a gentle slope from the north and west to the east and south. This plain is well dissected and becomes hilly next to the chief drainageways. The drainage from the greater part of the county is into Trinity River through several large creeks. All the streams in the county, except Trinity River, are intermittent.

The soils of the county are of marine sedimentary and alluvial origin. There are two classes of alluvial soils, those lying above flood level and those subject to overflow. Thirty-one soil types of 17 series are mapped, of which the Susquehanna and Ruston fine sandy loams and the Norfolk fine sand cover 28.8, 17, and 10.6 per cent of the area, respectively. It is stated that the Susquehanna fine sandy loam is the most extensive and the most important agriculturally of the forested heavy subsoiled types.

Results of greenhouse and laboratory research in soil fertility, S. D. CONNER (*Amer. Fert.*, 55 (1921), No. 4, pp. 77, 78, 80).—In a contribution from the Indiana Experiment Station a brief summary of some of the work on soil fertility in progress at the station is presented.

It is stated that three-fourths of the soils of the State are acid and in need of phosphate.

In connection with the nitrogen question, it has been found that the nitrogen in muck is very unavailable. This was found to be especially true in field tests with wheat where muck nitrogen was compared with dried blood nitrogen. Neither air-dried nor kiln-dried muck was of value, and both neutral and acid muck gave the same results. It is concluded that if muck is used as an ingredient of a fertilizer, no value should be assigned to the nitrogen which it contains.

Pot tests with corn to compare certain common carriers of nitrogen showed that sodium nitrate was the most effective, with ammonium sulphate second. Smaller yields were obtained with dried blood and still smaller yields with calcium cyanamid. Hydrolyzed leather was only 11 per cent as available as sodium nitrate, while aluminum nitrid, either with or without acid phosphate, proved to be entirely unavailable.

Studies of sulphur as a factor in the fertility of Indiana soils have shown that no one test has given results which consistently indicate the need for sulphur as a plant food.

The influence of certain fertilizer salts on the growth and nitrogen content of some legumes, A. MACTAGGART (*Soil Sci.*, 11 (1921), No. 6, pp. 435-455, figs. 2).—Experiments conducted at Cornell University, to determine what fertilizing elements, other than calcium, and what combinations of fertilizing elements best promote nitrogen fixation by alfalfa, soy beans, and Canada field peas, and to investigate the effect of fertilizer salts and of the resulting crop growth on subsequent soil nitrification, are reported. The soil used was a mixture composed of clean sand and a small percentage of sandy loam soil.

Of all the fertilizer elements applied to the compounded soil, phosphorus showed the greatest effect. It markedly increased the dry matter and total nitrogen and to a lesser extent the percentage of nitrogen in all three legumes, the order of greatest average influence on the crops being Canada field peas, soy beans, and alfalfa. Phosphorus used alone markedly increased the total nitrogen, dry matter, and percentage of nitrogen in the order named in all three crops, and in combination with nitrogen, potassium, and sulphur it markedly increased the dry matter and total nitrogen. However, it increased the percentage of nitrogen in soy beans and alfalfa only slightly, if at all, and decreased the percentage in the case of peas.

As a single element, nitrogen apparently did not benefit the plants with respect to yields of either dry matter or nitrogen or the percentage of nitrogen, except in the case of Canada field peas. In combination with phosphorus, potassium, and sulphur, nitrogen promoted no more response in the legumes than where it was used alone, but did not hamper the process of nitrogen assimilation.

Potassium used alone showed its greatest influence in increasing on the average the total nitrogen and dry matter in Canada field peas and alfalfa, in the order named. In soy beans, however, it showed a decrease with respect to these factors. Only in the percentage of nitrogen did potassium show an increase common to all three crops, and this in the crop order named.

Sulphur in the form of gypsum used alone and in combination with other fertilizer salts increased the growth and nitrogen content of alfalfa somewhat, but appeared not to have any effect on field peas and soy beans.

It is stated that in general when any application of fertilizer, with the exception of gypsum, increased the yield of the legumes grown, there was also an increase in the percentage of nitrogen in the plants. Where phosphorus was applied there was in general the greatest nitrate accumulation after all crops. Thus salts or their combinations which most markedly promoted the growth of legumes, as did phosphorus, usually caused the greatest nitrification. Nitrogen applied alone increased soil nitrification after all three crops, particularly after alfalfa, but when this nutrient was applied in combination with the other substances it did not have such an effect.

Potassium in the form of muriate of potash apparently slightly inhibited nitrate-nitrogen accumulation. Sulphur in the form of gypsum increased nitrification in soil in which alfalfa had grown but not in soil in which peas and soy beans had grown. There appeared to be a connection between the effect of sulphur on the crop and on nitrification following the crop. In general there appeared to be a tendency toward correlation between the dry matter produced and the subsequent soil nitrification. This is assumed to be partially due to the greater root system associated with greater top growth, hence to greater amounts of decayed roots for promoting nitrification.

The retention of soluble phosphates in calcareous and noncalcareous soils, W. H. HARRISON and S. DAS (*India Dept. Agr. Mem., Chem. Ser., 5 (1921), No. 9, pp. 195-236, figs. 8*).—Investigations to determine the predominating factors governing the distribution of soluble phosphates through calcareous and noncalcareous soils are reported. The work was divided into three parts.

In part 1 a study of the reaction between mono and dicalcium phosphates and calcium carbonate was conducted. It was found that the reaction between calcium carbonate and monocalcium phosphate at ordinary temperatures is a very rapid one, resulting in the formation of dicalcium phosphate, together with small quantities of tricalcium phosphate. Dicalcium phosphate when present in solution was also found to react rapidly with calcium carbonate to form tricalcium phosphate. The reaction between solid dicalcium phosphate and calcium carbonate in the presence of water was, however, much slower in character, and a considerable period of time was necessary for its completion.

During the course of the reaction carbon dioxid was produced which, by increasing the number of calcium ions in solution, reduced very materially the quantity of phosphoric acid formed in solution. Consequently, with calcareous soils the importance of cultural conditions which will tend to keep the carbon dioxid content of the soil gases at a minimum and thus permit of a greater concentration of phosphoric acid in the soil solution is considered to be apparent. Assuming that the phosphoric acid of superphosphate may be retained in soils both by absorption and by chemical combination, the rapidity of the reaction with calcium carbonate leads to the conclusion that the retention in calcareous soils will be determined mainly by the latter factor.

In part 2 studies to determine the factors governing the retention of soluble phosphates in calcareous and noncalcareous soils are reported. These showed that soluble phosphates which do not react with calcium carbonate are retained by absorption in both calcareous and noncalcareous soils. Soluble phosphates of the type of monocalcium phosphate, which readily react with calcium carbonate, were retained through adsorption in noncalcerous soils. In calcareous soils, on the other hand, the experimental values obtained showed that other factors than absorption have an influence.

Studies by means of percolation experiments on the distribution of soluble phosphates through calcareous and noncalcareous soils are reported in part 3. These showed that the distribution of superphosphate through a noncalcareous soil by percolation was of a uniform type and a function of

the depth of percolation. The phosphoric acid penetrated to a considerable depth in accordance with the laws of adsorption, and consequently the effect of applications of superphosphate to such soils is considered to be widespread. The distribution in the case of calcareous soils was found to be of a non-uniform type, the major portion of the phosphoric acid being held in the top layers of soil. Consequently it is thought that the application of superphosphate to these soils has a very restricted effect, and has therefore probably much less efficiency than equivalent amounts applied to soils of the opposite type. In proportion to the amount of superphosphate applied to the columns of soil, the soil solution of calcareous soils contained a much lower concentration of phosphoric acid than the noncalcareous soils. This is taken to indicate that the phosphoric acid retained was in a much more available form in the latter soils.

The fact that when calcium carbonate was added to a noncalcareous soil the experimental results conformed to those obtained with calcareous soils is taken to indicate that calcium carbonate is the main factor in determining the range of action and distribution of phosphoric acid in soil. The retention of superphosphate in calcareous soils is concluded to be of a chemical nature, due to the formation of insoluble calcium phosphates, and distinct from the physical retention by noncalcareous soils.

In this connection a percolation experiment with a soluble phosphate having little or no chemical reaction with calcium carbonate and a calcareous soil was conducted. This showed that a comparatively small amount of phosphoric acid was retained by the first section of soil, and the retained phosphoric acid was distributed more uniformly through the column of soil than was the case with superphosphate. The amount of phosphoric acid in solution in each section was high and was fairly uniformly distributed. The soluble phosphoric acid percolated to the deep layers and was there found in a comparatively high concentration. It is considered evident, therefore, that by using dressings of soluble phosphates, which have little or no reaction with calcium carbonate, in place of superphosphate on calcareous soils, a much more uniform distribution of the phosphoric acid throughout the soil can be attained.

It is concluded that manuring with superphosphate is relatively much more inefficient in calcareous than in noncalcareous soils.

Liming, with special reference to the uses of ground limestone, J. J. GRIFFITH (*Jour. Min. Agr. [London]*, 28 (1921), No. 4, pp. 341-349, pl. 1).—In a contribution from the University College of Wales a summary of the results of different experiments on the use of lime on the soils of Wales is given. Particular attention is drawn to a series of experiments to ascertain the influence of the degree of fineness upon the efficiency of ground limestone.

These showed that grassland crops did not respond to any appreciable extent to ground limestone which could not pass through a No. 100 sieve. In the case of the finest grade, which was less than 0.01 in., the effect upon the crop was very marked. It is observed that the superiority of the finest grade was even more striking with the second crop than with the first. This is taken to indicate that particles over 0.01 in. in size not only failed to have any appreciable immediate influence upon growth, but also did not succeed in assisting the crop even several months after applications.

Other studies have shown that burnt lime is much superior to ground limestone for improving the texture of heavy clay soils. However, in view of the increased cost of fuel and the improvements which have been effected in the construction of pulverizers and crushers, it is concluded that ground limestone may be used under many circumstances as a substitute for burnt lime.

Further studies on relation of sulphates to plant growth and composition, H. G. MILLER (*Jour. Agr. Research* [U. S.], 22 (1921), No. 2, pp. 101-110).—In a continuation of studies on the subject, conducted at the Oregon Experiment Station (E. S. R., 41, p. 427), it was found that sodium and calcium sulphates had a beneficial effect on nodule development and nitrogen assimilation of red clover grown on previously sterilized soil. On a similar series which was artificially inoculated with *Bacillus radicicola* at the time of seeding, sulphates caused no increase in nodule development.

When a soil of high sulphur content was used, the nitrogen content in clover of the third and fourth crops was lower on the control pots than where either sulphur, calcium sulphate, or sodium sulphate was applied. The ratio of nitrogen to sulphur in the portion of the clover plant insoluble in dilute acetic acid remained about the same, regardless of the stage in the development of the plant. The total nitrogen and nitrogen insoluble in acetic acid were higher in those plants cut before the blossoming stage.

When clover was grown on sand cultures it was possible, by reducing the available nitrate, not only to limit the growth and nitrogen content but also to decrease the sulphur assimilation. Rape assimilated a large amount of sulphur, although the presence of sulphates reduced the yield. Sulphate plus nitrate caused greater yields than when nitrate was used alone. There did not appear to be any direct relation between nitrogen and sulphur assimilation in the rape plant.

Effects upon the growth of potatoes, corn, and beans resulting from the addition of borax to the fertilizer used, J. R. NELLER and W. J. MORSE (*Soil Sci.*, 12 (1921), No. 2, pp. 79-131, figs. 31).—In a contribution from the New Jersey and Maine Experiment Stations experiments are reported, the chief purpose of which was to determine whether the injuries previously observed, both in the field and in the greenhouse, from the use of fertilizers containing borax were due to the presence of the borax alone, and to determine the maximum amount of borax that can be applied per acre to land growing potatoes, corn, and beans. All of the fertilizers used consisted of a single base mixture prepared from materials of known composition and free from borax.

It was found that potatoes, corn, and beans were uninjured where fertilizer mixtures containing no borax were applied to soil in pots. These crops were injured where the pots contained the same soil and the same fertilizer mixtures in like quantity, provided sufficient amounts of borax were added with the fertilizer. The same types of injury were produced in somewhat greater degree when a commercial fertilizer carrying equivalent amounts of borax was applied.

Corn and beans were more susceptible to the injurious influence of borax than potatoes. Under the conditions of the experiment, anhydrous borax at the rate of 3 lbs. per acre was the largest amount that could be applied in drills with safety to beans. The limit for corn was somewhat less than 5 lbs. and for potatoes slightly more than 5 lbs. per acre. Borax applied with the fertilizer below the seed or seed piece proved more toxic in all cases than where applied above in like manner. Mixing the borax and fertilizer with the soil decreased the injury and slightly increased the amount that could be applied per acre with safety.

Evidence was obtained that applications of lime prevented some of the injury to potatoes. Tests with gypsum and manure were not conclusive with this crop. All three of these materials seemed to reduce the toxic effects on corn. Lime was beneficial with beans, but gypsum and manure did not show any appreciable influence.

The above results were all obtained with soil at an optimum water content of 19.2 per cent. A subsequent test with beans showed that more injury occurred where the soil moisture was maintained at 15.2 per cent than where it was 30.4 per cent.

The only indication of possible stimulation due to the presence of small amounts of boron occurred with corn, but the evidence was not conclusive.

New fertilizers, A. GRÉGOIRE (*Ann. Gembloux*, 27 (1921), Nos. 3, pp. 81-88; 4, pp. 117-131; 5, pp. 156-164, figs. 3).—The author reviews the progress of the fertilizer industry during the past few years, drawing particular attention to the development of nitrogenous fertilizers. Data are also included on the development of phosphatic and potassic fertilizers, lime compounds, and catalytic and radioactive fertilizers.

Analyses of commercial fertilizers, R. N. BRACKETT and H. M. STACKHOUSE (*South Carolina Sta. Bul.* 208 (1921), pp. 3-48).—This bulletin contains the results of actual and guaranteed analyses and relative commercial valuations of 763 samples of fertilizers and fertilizer materials collected for inspection in South Carolina for the season 1920-21.

Commercial fertilizers in 1920-21, G. S. FRAPS and S. E. ASBURY (*Texas Sta. Bul.* 280 (1921), pp. 3-22).—This bulletin reports the results of actual and guaranteed analyses of 291 samples of fertilizers and fertilizer materials collected for inspection in Texas during the fiscal year 1920-21, together with a list of brands registered for sale.

AGRICULTURAL BOTANY.

Agricultural bacteriology, J. PERCIVAL (*London: Duckworth & Co.*, 1920, 2. ed., pp. X+407, figs. 59).—This is the second edition of this textbook (E. S. R., 25, p. 225).

Device for growing large plants in sterile media, J. K. WILSON (*Phytopathology*, 10 (1920), No. 9, pp. 425-429, fig. 1).—The author describes a method for growing large plants in sterile media, and he claims to have grown to maturity maize, peas, and oats by the method given.

On the changes through which the nodule organism passes under cultural conditions, W. F. BEWLEY and H. B. HUTCHINSON (*Jour. Agr. Sci. [England]*, 10 (1920), No. 2, pp. 144-162, pls. 3, fig. 1).—It is claimed that under certain cultural conditions the nodule organism from roots of red clover, broad bean, alfalfa, and lupine exhibits a tendency toward granular disintegration of the cell with the formation of small nonmotile coccoid bodies, about 0.4μ in diameter, constituting on soil extract media the predominant type. A life cycle consisting of five stages is described. The effect of temperature has been studied.

Effect of soil temperature upon the development of nodules on the roots of certain legumes, F. R. JONES and W. B. TISDALE (*Jour. Agr. Research [U. S.]*, 22 (1921), No. 1, pp. 17-31, pls. 3, figs. 4).—In a contribution from the Bureau of Plant Industry, U. S. Department of Agriculture, and the Wisconsin Experiment Station, the results are given of preliminary studies on the effect of soil temperature on the development of alfalfa, red clover, field peas, and soy beans, with special reference to the infection of these plants by *Bacillus radicicola* and the subsequent development of nodules. As was anticipated, the four plants differed in their ability to tolerate soil temperatures at the end of the series.

In regard to the number of nodules formed on the plants, irregularities were found in each temperature series, but no large differences were discovered

except that at the upper and lower limits at which plants will survive the number was reduced. All species were found to form nodules in soils at any temperature at which growth that is at all vigorous can be made. While the variations in the number of nodules were not consistent, size as measured by average dry weight per plant was found to differ greatly and consistently in the series, at least so far as the soy bean was concerned. The maximum weight attained on the soy bean plant after a period of two months was found on plants grown at a soil temperature of 24° C (75.2° F.). Examination of nodules on the roots of other legumes indicated that their maximum production occurred at about the same temperature.

Weights of nodules produced by soy beans were not found to be correlated with the weights of tops or roots through the series of temperatures. Weight of tops was almost as great at 30 to 36° as at 24°, while the weight of nodules declined rapidly at the higher temperatures. With the soy bean plant, and to a less marked degree with the other plants, there was found a correlation between the weight of nodules and the color of the plant, the largest weight of nodules occurring on plants with the palest green color.

In general, plants with large nodules were found to have a higher percentage of nitrogen in the tops, although this correlation is not absolute.

Soil moisture, concentration of nitrates, and the hydrogen-ion concentration of the soil were all investigated in connection with the nodule formation, and it is believed that variations in any of these factors do not play an important part in variations in nodule development at the different temperatures in the series.

Some notes on *Fragaria*, C. W. RICHARDSON (*Jour. Genetics*, 10 (1920), No. 1, pp. 39-46, figs. 2).—Having continued experimentation previously noted (E. S. R., 41, p. 738), the author reports detailed results of studies on *Fragaria* varieties and crosses regarding such qualities as flower color, double flowering, foliage variegation, and fruit characters.

Occurrence of quercetin in Emerson's brown-husked type of maize, C. E. SANDO and H. H. BARTLETT (*Jour. Agr. Research [U. S.]*, 22 (1921), No. 1, pp. 1-4).—The results are given of a study carried on cooperatively between the Bureau of Plant Industry, U. S. Department of Agriculture, and the department of botany, University of Michigan, on the identification of the pigments occurring in a brown-colored type of corn which is said to have first appeared in Emerson's cultures as a segregate in the second generation of a cross of purple and green.

In accordance with the expectation that the brown-husked type of maize would be found to contain a flavonol, the authors isolated from brown husks a free quercetin and a quercetin glucosid. The two compounds in question are both lemon yellow in color, and if they account for the truly brown-husked color of this type, it is thought to be probably due to their adsorption on some colloid component of the brown tissues. It is believed probable that the quercetin glucosid is the counterpart in the brown type of the anthocyanin of the purple type.

Observations on black eye in pea, A. MEUNISSIER (*Jour. Genetics*, 10 (1920), No. 1, pp. 53-60).—Black eye and uncolored eye in pea have been shown by breeding tests (conducted by P. Vilmorin and now posthumously reported) to be a pair of allelomorphs in which the former is dominant. Details are presented of studies on the results of different crossings, which are indicated.

A preliminary note on the flower color and associated characters of the opium poppy, H. M. LEAKE and B. R. PERSHAD (*Jour. Genetics*, 10 (1920), No. 1, pp. 1-20, pl. 1).—In considering the possibility of producing in India an

opium of high morphine content, an investigation was started with a view to isolating as many races as possible which could later form the basis for appropriate further study.

This preliminary work deals principally with the various factors and combinations thereof supposedly influential in heredity. The results indicate that the solution of the problem is not to be found in any of the colored races. These produce so large a number of heads as to require too great a range of time for maturation. Some of the single-capsuled white-flowered races yield opium containing as high as 18 per cent morphine. A simple and efficacious method of obtaining opium containing 10 to 14 per cent morphine has been indicated by the chemical study.

Genetic studies in potatoes, R. N. SALAMAN and J. W. LESLEY (*Jour. Genetics*, 10 (1920), No. 1, pp. 21-37, pls. 4).—Studies are noted regarding the inheritance of an abnormal haulm type of potato which is designated as prostrate. This hereditary prostrate habit appears to be due to excessive haulm weight combined with deficient turgidity. The prostrate variety breeds true. The genetic relations, so far as ascertained, show that the prostrate differs from the upright form in at least two and probably in three factors, also that the prostrate habit is not correlated with other characters.

Rejuvenescence and improvement of potato, L. MALPEAUX (*Vie Agr. et Rurale*, 10 (1921), No. 23, pp. 359-364, figs. 3).—Discussion is given of the phenomena and causation of degenerescence in potato and of measures tried or recommended to combat such tendencies.

The rôle of osmosis in biology, M. LECLERC DU SABLON (*Le Rôle de l'Osmose en Biologie*. Paris: Ernest Flammarion, 1920, pp. VI+7-190, figs. 20).—This book deals mainly with plant physiology. The chapters relate severally to osmosis, turgescence and plasmolysis, variations in permeability, absorption, circulation, emission of liquids, transpiration, the rôle of permeability, the inutility of transpiration, adaptations, and gaseous exchanges.

All the exchanges, whether between the cells themselves or between the cells and the external medium, are determined by the laws of osmosis. The permeability of membranes is an essential factor in the physiology of plants.

The antagonistic action of anions, O. L. RABER (*Jour. Gen. Physiol.*, 2 (1920), No. 5, pp. 541-544, figs. 2).—A quantitative study of antagonism between anions employing, in connection with sodium acetate and sodium sulphate, the marine alga *Laminaria agardhii*.

A quantitative study of the effect of anions on the permeability of plant cells, O. L. RABER (*Jour. Gen. Physiol.*, 2 (1920), No. 5, pp. 535-539, figs. 2).—The author, employing the method indicated by Osterhout (*E. S. R.*, 41, p. 819), has investigated the effects of a series of anions on the permeability of *Laminaria agardhii*, and has presented the results in graphical form.

Influence of the concentration of electrolytes on the electrification and the rate of diffusion of water through collodion membranes, J. LOEB (*Jour. Gen. Physiol.*, 2 (1919), No. 2, pp. 173-200, figs. 16).—The effect of concentration (gas pressure effect) shown in the initial diffusion rate of a sugar solution separated with a collodion membrane from pure water is observable also in case of electrolyte solutions, but in this case the effect becomes noticeable at somewhat higher concentrations than M/64, namely at M/16 or more.

Solution of electrolytes of concentrations lower than M/8 or M/16 exercise a specific influence on the initial rate of diffusion of water through a collodion membrane from pure solvent into solution, which is not found in the case of the solutions of nonelectrolytes and which is due to the fact that the particles of water diffuse in this case through the membrane in an electrified condition.

The sign of the charge depends upon the nature of the electrolyte in solution, according to two rules given in a preceding paper (E. S. R., 42, p. 130).

Within a range of concentrations between M/256 and M/16 or more, a reversal of expectation under the Van't Hoff law is noted, the attraction of a solution of a electrolyte for water diminishing in this case with an increase in concentration. Without making a definite assumption concerning the origin of the electrification of water and concerning the mechanism whereby ions influence the rate of diffusion of water particles through collodion membranes from pure solvent to solution, the author presents the results in terms of attraction and repulsion of the charged particles of water by the ions.

On the cause of the influence of ions on the rate of diffusion of water through collodion membranes, II, J. LOEB (*Jour. Gen. Physiol.*, 2 (1920), No. 5, pp. 563-576, figs. 8).—The author intends and claims to complete in this note the proof offered above that the influence of the concentration of electrolytes on the transport of water through a collodion membrane is similar in the case of free and of electrical endosmosis. On the basis of the Helmholtz theory of electrical double layers, this seems to indicate that the influence of an electrolyte on the rate of diffusion of water through a collodion membrane in the case of free osmosis is due to the fact that the ion possessing the same sign of charge as the membrane increases the density of charge of the latter, while the ion with the opposite sign diminishes the density of charge of the membrane.

Comparative studies on respiration.—XI, The effect of hydrogen-ion concentration on the respiration of *Penicillium chrysogenum*, F. G. GUSTARSON (*Jour. Gen. Physiol.*, 2 (1920), No. 6, pp. 617-626, figs. 2).—Continuing the studies previously noted (E. S. R., 43, p. 820), the author conducted a series of experiments with *P. chrysogenum*, which was chosen because it does not under the conditions produce sufficient alkali or acid (other than carbonic) to interfere with the results, also because of its hardness.

It was found that variations in the pH value between 4 and 8 produce practically no effect on the normal rate (rate at neutrality) of respiration. Increasing the pH value to 8.80 causes respiration to fall to 60 per cent. Decreasing the pH value to 2.65 causes a gradual rise and return to normal. At pH 1.10 to 1.95 the preliminary rise amounts to 20 per cent and is followed by a fall to a point below the normal.

Decreases in respiration produced by solutions having a pH value of 1.95 or less are irreversible. A similar decrease occurring at pH 8.80 is reversible, the rate coming back to practically normal after the material is replaced in a neutral solution.

Phenomena of growth in microorganisms and the question of chronodriomes, N. BEZSSONOF (*Centbl. Bakt. [etc.]*, 2. Abt., 50 (1920), No. 20-25, pp. 444-464, pl. 1).—A study of microorganisms on substrata containing highly concentrated cane sugar is presented in detail as to the morphological, cytological, and physiological data obtained.

The nature of the growth rate, H. S. REED (*Jour. Gen. Physiol.*, 2 (1920), No. 5, pp. 545-561, figs. 6).—A study of shoot growth rate in the pear and walnut leads to the conclusion that this process may be regarded as a chemical reaction giving the mature organism as end product. The organism grows at a definite rate which is at any moment proportional to the amount of growth yet to be made. Shoots of young pear trees measured at weekly intervals during the growing season showed a rate similar to that of an autocatalytic reaction. Young walnut trees showed distinct cycles of growth in a single season, but growth in each cycle proceeded at a rate corresponding to an autocatalytic reaction.

The growth rate follows a definite, quantitative course though judged by different criteria. Data are presented for maize in which green weight, dry weight, and height of the plant are used.

The significance of the cambium in the study of certain physiological problems, I. W. BAILEY (*Jour. Gen. Physiol.*, 2 (1920), No. 5, pp. 519-533, pl. 1, figs. 4).—Investigations carried on with cambium for some years having suggested this structure as a favorable medium for study of certain theoretical problems, particularly the working sphere of the nucleus, the nucleocytoplasmic relation, and the dynamics of karyokinesis and cytokinesis, the author calls attention to certain phenomena which are to be described and discussed in a later series.

The adjacent, undifferentiated, uninucleate cells of the lateral meristem or cambium, presenting two distinct shapes and sizes, are described.

Transpiration studies with the apple, F. P. CULLINAN (*Amer. Soc. Hort. Sci. Proc.*, 17 (1920), pp. 232-240).—Experiments were begun in 1918 on a study of the relative transpiration of leaves of apple trees under different soil and pruning treatments. The data secured from work done during three seasons as here detailed, while not settling the question as to relation of transpiration to growth, indicate that under the conditions employed neither relative nor total transpiration (because of the many factors which may affect growth) is a reliable index to growth activity in apple trees.

Injurious action [upon plants] of emanations from the works at Chedde, L. MANGIN (*Min. Agr. [France], Ann. Serv. Épiphyties*, 6 (1918), pp. 187-199, figs. 8).—An account is given of foliage injury, chiefly to conifers, in the region near Chedde, throughout which are distributed gases and fumes. Particular mention is made of hydrochloric acid, which is supposed to be highly injurious, perhaps not less so than sulphuric acid. Some physiological factor is also involved, the nature of which has not been determined. The supposed action of hydrochloric acid appears to be confined to periods within which water is present on the foliage. This acid is supposed not to enter the leaf tissue in a gaseous condition.

A theory of injury and recovery.—I, Experiments with pure salts, W. J. V. OSTERHOUT (*Jour. Gen. Physiol.*, 3 (1920), No. 2, pp. 145-156, figs. 3).—Laminaria exposed to 0.52 M NaCl loses part of its electrical resistance if the period is short, recovering slowly if the period of exposure is longer, but not at all if the period is sufficiently prolonged. After exposure to 0.278 M CaCl₂ the resistance falls when the tissue is replaced in sea water. Equations are developed for the purpose of predicting tissue resistance and recovery curves.

Quantitative laws in regeneration, II, J. LOEB (*Jour. Gen. Physiol.*, 2 (1920), No. 6, pp. 651-657, figs. 3).—This continues directly work previously reported (E. S. R., 43, p. 821), but notes results more striking in some respects than those recorded on the same page in a report of later work. In these experiments the quantity of roots formed had not been measured directly but had been calculated.

Experimentation here noted is thought to show that when a leaf is connected with a stem which prevents regeneration the inhibitory affect is due to the fact that the material available for the regenerative growth in the notches of the leaf flows into the stem. The fact that when a piece of stem is left in connection with a leaf the inhibitory effect on the formation of roots in the leaf increases with the size of the piece of the stem, but less rapidly, is said to be due to the fact that the increase in mass of the stem is not the same throughout the whole length of the stem, but that it is greater at the base and possibly (to a lesser degree) in the region of a node.

FIELD CROPS.

The nomenclature of agricultural plants, W. H. PARKER and H. CHAMBERS (*Jour. Min. Agr. [London]*, 28 (1921), No. 2, pp. 167-180).—The authors discuss the present situation in the United Kingdom regarding profusion and confusion of "new" and "improved" varieties of field crops and vegetables, and summarize remedial measures followed in Germany, Denmark, Holland, Australia, and the United States.

It is felt that among all the named varieties now on the market, a large number could be eliminated as being either identical or distinctly inferior under any conditions to other varieties of the same crops. Remedies proposed include registers, the original entries being those existing standard varieties in the authentic list compiled by committees of experts. Subsequent stocks would be eligible only on proof of conscious efforts by the producers over a series of years culminating in improvement. The naming of any variety or strain merely because it presents new characteristics should be discouraged. Proved merit should be the criterion on which a variety or strain should be granted entry to its appropriate register.

Contributions to the principles of breeding certain agricultural plants.—
V, Grasses, 2, C. FRUWIRTH (*Naturw. Ztschr. Forst u. Landw.*, 18 (1920), No. 7, pp. 169-178).—Observations on the flowering conditions and experiments in pollination of important cultivated grasses, including species of *Dactylis*, *Poa*, *Festuca* and *Lolium*, together with *Phleum pratense*, *Alopecurus pratensis*, *Avena flavescens*, and *Arrhenatherum elatius* are discussed in continuation of earlier work (E. S. R., 36, p. 332). Conclusions on these investigations have been noted previously.

The condition of permanent meadows, R. G. STAPLEDON (*Jour. Min. Agr. [London]*, 28 (1921), No. 3, pp. 207-215).—A detailed examination in 1920 in certain counties in Wales and southwestern England indicated that average meadow land was more neglected and relatively less productive in relation to its potential capacity than the pastures. See also previous notes (E. S. R., 37, p. 230; 38, p. 635). Results of experiments at various experimental centers showed a gradual decline in yields of meadow hay, seeded hay averaging 672 lbs. more per acre throughout the country. Besides the decline in yield, the worst defect of meadow hay is its excessive weediness.

The weeds depreciating meadows to the greatest extent are *Rumex acetosa*, *Rhinanthus* spp., *Anthriscus sylvestris*, *Heracleum spondylium*, *Spiraea ulmaria*, *Centaurea nigra*, *Chrysanthemum leucanthemum*, *Taraxacum officinale*, and *Plantago lanceolata*. Weediness of meadows in England is held chiefly due to the complete withholding of fertilizers, excessive use of farmyard manure, late cutting of hay, and using fields as meadows for excessive periods.

Pasture studies: Some results, T. J. JENKIN (*Bangor, Wales: Jarvis & Foster*, 1921, pp. 58).—This treatise reports results of studies of pasture herbage in western Wales, largely noted heretofore (E. S. R., 37, p. 230). The botanical compositions of the herbage of pastures studied with respect to the history of individual species by the percentage frequency and specific frequency methods are given, together with details of seed mixtures used. The effects of altitude, topography, cultivation, after treatment, and seed mixtures on pasture herbage are discussed in considerable detail.

Marketing hay at country points, H. B. McCLURE and G. A. COLLIER (*U. S. Dept. Agr. Bul.* 977 (1921), pp. 27, fig. 1).—Information is given regarding the preparation and marketing of hay at country points. The authors point out the importance of time of cutting in hay production, and discuss the effects

of improper curing, faulty methods of baling, and undesirable mixtures on the quality of the product. In a consideration of present methods of marketing hay at country points throughout the United States, the functions and qualifications of the country shipper are described and general marketing practices and methods of handling hay at the shipping points explained, together with a note on the cost of marketing hay by the producer.

Marketing hay through terminal markets, G. A. COLLIER and H. B. McCLEURE (*U. S. Dept. Agr. Bul. 979 (1921), pp. 52, figs. 6*).—The customs and practices prevailing in the various markets are described for the benefit of producers and others interested in the marketing of hay. The functions and methods of the country dealer and the several classes of dealers at terminal markets in shipping and disposing of hay are discussed in detail, with observations on unfair practices sometimes encountered in the trade. The location and preferences of consuming territories are indicated, and the methods of wholesalers and retailers in distributing the product to the consumer are outlined. A table sets forth the requirements of the various eastern, western, and southern hay markets, showing kinds of hay received, types of bales, methods of inspection, weights, and the most common faults that affect the selling price. In conclusion, suggestions are offered for improvement in the methods of marketing hay.

Crop rotation and cultural methods at Edgeley, N. Dak., J. S. COLE (*U. S. Dept. Agr. Bul. 991 (1921), pp. 24, figs. 4*).—An analysis of the results of experiments in crop rotation and cultivation methods conducted at the Edgeley Substation (E. S. R., 45, p. 225) in cooperation with the North Dakota Experiment Station. Notes are given on soil and climatic conditions, and sod crops and the effect of the season on yields are discussed.

Results of trials involving the use of barnyard manure, green manures, sod crops, and commercial fertilizers at the station showed that soil fertility is not a limiting or controlling factor of major importance in crop production at Edgeley. The seasonal variation in yields indicate that the chief controlling factor is the seasonal rainfall, the full operation of which is interfered with by plant diseases, chiefly rust. Attempts to overcome this control by cultural means met with but limited success, and the application of the general principles of good husbandry is recommended instead.

The time of plowing, fall or spring, is considered of minor importance if seeding is not unduly delayed. While fallow may be useful as an emergency measure for cleaning up land infested with weeds or in preparing an excess acreage for a crop the following season, it does not increase the yield over that on cropped land enough to warrant a recognized place in the cropping system. Green manuring is entirely unjustifiable, increasing expense but not yields. Although the effect of barnyard manure is comparatively small, it appears to be cumulative. Manure should be applied in preparation for the corn crop in a systematic rotation.

In 14 years corn has averaged a little less than 9 bu. of grain and about 3,600 lbs. of stover or fodder per acre. It deserves, however, an important place in the rotation, as the yields of small grain following corn are materially increased over those after small grain, and fully equal or even exceed those on fallow.

Alfalfa has proved a valuable sod crop, but it does not lend itself to short rotations as well as brome grass, which has been a sure and reliable hay crop. In a rotation alfalfa apparently depressed the yield of the crops immediately following. Brome grass has had a slightly depressing effect on the first crop following it, but fields of succeeding crops were not affected. The sod crops should enter into the rotation only as it is necessary to make new

seedings and break up the old, in order to maintain the maximum production of brome grass or alfalfa. The remaining ground should be in a rotation of corn on spring plowing, followed by wheat on disked corn ground, and the latter by wheat, oats, or barley, preferably on fall plowing. If this provides too large an acreage of corn, the rotation may be lengthened by allowing small grain to follow small grain for a greater number of years.

[**Report of field crops work in Montserrat, 1919-20**], F. WATTS (*West Indies Imp. Dept. Agr., Montserrat Agr. Dept. Rpt., 1919-20, pp. 3-12, 14-16, 22-26, 29-32*).—The continuation of work with field crops along the same general lines as heretofore (E. S. R., 44, p. 827) is reported.

[**Field crops work at University College, Reading**], H. A. D. NEVILLE ET AL. (*Univ. Col., Reading, Guide Col. Farm and Expt. Sta., 1921, pp. 12-43, 45-60*).—These pages describe the progress of experiments with fertilizers and grass mixtures on permanent grasslands and pastures; rotations, liming, and variety trials with oats, wheat, potatoes, and mangels; fertilizer tests with potatoes, oats, mangels, and swedes; field trials with sugar beets, corn, alfalfa, and flax; and plat tests of the principal forage and root crops with their wild prototypes.

When mangels, after singling, were hoed once, hoed twice, kept clean by hoeing, or kept clean by hand weeding, they returned average acre yields of 25.4, 27, 27.7, and 26.1 tons respectively, as compared with 9.7 tons from those untreated. Nitrate of lime gave the largest return in trials of nitrogenous fertilizers on mangels.

[**Field crops work at Lauchstädt and Gross-Lübars**], D. MEYER, F. MÜNTER, W. GRÖBLER, and W. SCHNEIDEWIND (*Landw. Jahrb., 51 (1918), No. 1, pp. 151-208*).—Variety trials with winter and spring wheat, rye, barley, oats, peas, mangels, and sugar beets; rotations, fallowing, and miscellaneous cultural experiments with cereals; and spacing, size of seed, and topping experiments with potatoes, are reported for the period 1910-1916, inclusive. Previous work with wheat, oats, and barley varieties has been noted (E. S. R., 23, p. 335).

[**Report of field crops work in India, 1919-20**] (*India [Dept. Agr.] Rev. Operations, 1919-20, pp. 2-32, 35-40, pl. 1*).—These pages review the progress of investigational work (E. S. R., 45, p. 532), conducted by the Imperial and Provincial Departments of Agriculture in the year 1919-20 in various centers in India with rice, wheat, cotton, sugar cane, jute and other fibers, tobacco, oil seeds, fodder crops, grasses, and miscellaneous cereals, legumes, and root crops.

[**Report of field crops work in Bengal**], R. S. FINLOW ET AL. (*Bengal Dept. Agr. Rpt. 1919-20, pp. 4-6, 8-10; App. I, pp. I, II; III, pp. II, III; IV, pp. I-V; V, p. 1; VII, pp. 2-4; VIII, pp. 2, 3; X, p. 4; XI, pp. 2-4; XIII, pp. 1-5; XIV, pp. 7-13*).—Variety, cultural, and fertilizer tests with jute, rice, corn, potatoes, sugar cane, tobacco, and miscellaneous field crops were conducted at several experimental centers in Bengal in continuation of work already noted (E. S. R., 45, p. 34).

Rice grown at several elevations ranging from 3,317 to 3,800 ft. made the highest grain yields at the lowest levels and the greatest straw production at intermediate positions. Green-manured and untreated areas returned much greater yields of paddy, but less straw, than plats on which stable manure at the rate of 2 tons per acre was applied.

[**Roseworthy Agricultural College harvest report, 1920-21**], W. J. COLEBATCH (*Jour. Dept. Agr. So. Aust., 24 (1921), Nos. 8, pp. 670-684; 25 (1921), No. 1, pp. 7-15*).—In continuation of work noted heretofore (E. S. R., 43, p. 527), crop data and meteorological records are reported for the year 1920-21, and re-

sults of comparative trials of wheat varieties, selection, and hybrids are tabulated. Average acre yields on the college farm for 1920 were as follows: Berseem clover 28.76 tons, silage from barley 7.59 tons, wheat hay 2.51 tons, wheat 26 bu. 57 lbs., barley 21 bu. 30 lbs., oats 29 bu. 37 lbs., and rye 14 bu. 10 lbs.

Root development in barley and wheat under different conditions of growth, W. E. BRENCHELEY and V. G. JACKSON (*Ann. Bot. [London]*, 35 (1921), No. 140, pp. 532-556, figs. 4; *abs. in Rothamsted Expt. Sta., Harpenden, Rpt. 1918-1920*, pp. 30, 31).—The effect of various manures such as superphosphate, sulphate of potash, and nitrate of soda on the root systems of barley and wheat were observed in the investigations reported. The experiments were made largely in pot cultures and the roots washed out at regular intervals to obtain the various stages of development.

The two forms of roots produced were much branched roots, proceeding mostly from the grain, rather thin and long and bearing very numerous fine laterals, with root hairs only near the tip; and thick unbranched roots rising from the nodes as well as the grain, white in color, and their entire length densely covered with root hairs.

With barley, superphosphate encouraged the development of unbranched roots, but sodium nitrate had no effect. When the plants are about 3 months old, no more unbranched roots seem to be formed. Maximum root development was attained about the time that the spikes were ready for emergence from the sheaths. With superphosphate alone and with sodium nitrate alone, however, this maximum was reached somewhat earlier, indicating that root growth apparently culminated with the final stage of preparation for grain formation. A great increase of the shoot: root ratio occurred when the unbranched roots ceased to be formed.

With wheat the unbranched roots increase in numbers less rapidly than in barley, but persist as such for a longer period. Nothing in wheat corresponded to the sudden disappearance of white roots in barley about 11 weeks after seeding. The decline in white roots in wheat coincides with the decrease in weight of the whole root system, whereas in barley the formation of white roots stops suddenly when the ratio between shoot and root growths begins to change.

The development of the flower and grain of barley, W. E. BRENCHELEY (*Jour. Inst. Brewing*, 26 (1920), No. 12, pp. 615-632, figs. 5; *abs. in Rothamsted Expt. Sta., Harpenden, Rpt. 1918-1920*, pp. 31, 32).—The flowering habit in barley is to a large extent characteristic of the type, as in some cases the glumes open and in others remain closed at the time of pollination. Cross fertilization is impossible with closed-glume flowering and does not generally occur even with open flowering.

The developmental history of the grain indicated that the awns are of considerable physiological importance, being essentially transpiring organs. The largest and heaviest grains are found in the middle of every barley spike, and the occurrence of the longest awns on these grains indicates some correlation between weight of grain and length of awn. Transpiration is most active during the development of the spike and grains, rising to a maximum about the time the grains reach the milk stage.

The Robust bean, F. A. SPRAGG and E. E. DOWN (*Michigan Sta. Spec. Bul.* 108 (1921), pp. [11], figs. 5).—The Robust variety of common white navy bean, consistently outyielding all other varieties in comparative tests at the station and outstanding in trials elsewhere, originated from a healthy individual plant selected in 1908 from commercial beans exhibiting mosaic. The characteristics

of the variety and special cultural directions are set forth with brief accounts of selection and hybridization work, and varietal and rate of seeding trials.

Planting rates and spacing of corn, C. A. MOOERS (*Tennessee Sta. Bul. 124 (1921), pp. 31-43*).—Rate of planting and spacing experiments with different corn varieties, already noted (*E. S. R.*, 42, p. 632), are described, and tables are included showing variety groups with factors, the proper number of plants for various expected yields, and the distances for plants of each variety group in rows ranging from 3 to 4.5 ft. in width.

The report of the cotton experiment stations of the Chinese Cotton Mill-owners' Association, T. S. KUO (*Chinese Cotton Millowners' Assoc., Cotton Expt. Stas. Rpt., 1 (1920), pp. 5+[60], pls. 2, fig. 1*).—The work of the Chinese cotton experiment stations in acclimatizing American upland varieties, improving and standardizing native varieties, demonstrating improved cultural methods, and studying insect and disease control is described. The results of a limited variety test with American and Chinese varieties are given in an English summary with tabulated lint lengths and percentages and lint and seed indices.

Preliminary manufacturing tests of the official cotton standards of the United States for color for upland tinged and stained cotton, W. R. MEADOWS and W. G. BLAIR (*U. S. Dept. Agr. Bul. 990 (1921), pp. 12*).—Manufacturing tests were conducted in cooperation with the North Carolina State College of Agriculture and Engineering to determine the relative values of the following grades of cotton selected throughout the Cotton Belt: Low middling, good middling yellow tinged, middling yellow tinged, low middling yellow tinged, good middling yellow stained, middling yellow stained, good middling blue stained, and middling blue stained. Each grade was subjected to the same mechanical conditions used in earlier tests of the official cotton standards of the United States for upland cotton (*E. S. R.*, 38, p. 434).

The percentages of visible waste made by the different grades and the breaking strength in pounds per skein of 120 yds. of 22's yarn ($4.50 \times \sqrt{22}$) spun from these grades were as follows:

Strengths of yarn and percentages of visible waste from different grades of cotton.

Grade.	Visible waste.				Breaking strength.			
	White.	Yellow tinged.	Yellow stained.	Blue stained.	White.	Yellow tinged.	Yellow stained.	Blue stained.
	Per cent.	Per cent.	Per cent.	Per cent.	Pounds.	Pounds.	Pounds.	Pounds.
Good middling.....	.....	7.04	6.85	7.24	.....	85.7	87.2	76.6
Middling.....	.....	8.21	10.75	10.24	.....	88.5	82.9	79.5
Low middling.....	8.23	11.99	.....	.....	81.3	81.2	.....	.....

The bleaching and dyeing tests demonstrated that low middling, good middling yellow tinged, good middling yellow stained, and middling yellow stained can be bleached satisfactorily for white yarns, and when bleached, middling yellow tinged and low middling yellow tinged can be used for dyeing both light and dark shades, but good middling blue stained and middling blue stained can be bleached satisfactorily for dyeing dark shades only. The average of all single strand tests shows that the bleaching and dyeing processes do not materially affect the strength of the yarn.

Note on the deterioration of indigo seed during storing, W. R. G. ATKINS (*Agr. Research Inst. Pusa Indigo Pub. No. 10 (1921), pp. 9, fig. 1*).—In tests at

Pusa of Java indigo seed from Assam, light-colored seed germinated better than dark-brown or red seed. The latter colors are to be regarded as visible indications of aging, thought probably due to slow oxidation. Elongated seed seemed to die more rapidly than plump round seeds, and heavy seed retained their germinating vigor much longer than light seed. Only a few of the seeds swelling in distilled water without acid treatment were able to germinate after storage. Bergthell and Day¹ have shown that the cause of the failure of water to penetrate the seeds of Java indigo is the presence of an outermost layer in which the cellulose is covered by an extremely thin layer of cuticle. This layer is apparently not properly developed in the seeds which swell in water, and they are to be regarded as immature.

Jute and its manufacture, H. R. CARTER (*London: J. Bale, Sons & Danielsson, Ltd.*, [1921], pp. VI+192, figs. 70).—This handbook comprises detailed descriptions of the cultivation of jute, of the preparation, marketing, and grading of the fiber, and of the several processes involved in the manufacture of cloth from jute. Various aspects of the jute industry are discussed in an appendix.

Fulghum oats, T. R. STANTON (*U. S. Dept. Agr., Dept. Circ. 193* (1921), pp. 11, figs. 2).—The history, characteristics, adaptation, quality of grain, yielding ability, and time of ripening of Fulghum oats are discussed, and results of fall and spring seeded oats varietal experiments including this variety are summarized.

The Fulghum oat probably originated on the farm of J. A. Fulghum, Warrenton, Ga., about 20 years ago as a selection from the Red Rustproof variety. It differs from that variety chiefly in having fewer awns and in ripening about 10 days earlier. Results of experiments indicate that the yield of Fulghum oats from fall seeding compares favorably with that of Red Rustproof in parts of North Carolina, South Carolina, and Georgia, but not as well in Alabama, Mississippi, and Arkansas. Neither Fulghum nor Red Rustproof competed successfully with the hardy Winter Turf and Culberson varieties when fall seeded in the northern portion of the winter-oat belt. Experiments in Arkansas, Missouri, and Kansas show that the Fulghum variety is adapted for spring seeding in that section and probably will replace Burt. It is considered a most promising variety in Kansas, a strain being distributed under the name Kanota (*E. S. R.*, 45, p. 738). The yields of Fulghum at Ohio State University have been noted (*E. S. R.*, 45, p. 232).

North Dakota potato grades, E. F. LADD (*Agricultural College, N. Dak.: State Grain Insp. Dept.*, 1920, pp. 8).—The grades for potatoes and seed potatoes, established in accordance with the Uniform State Grain Grading Act of 1919, are described and compared with Minnesota grades, and United States grades (*E. S. R.*, 43, p. 335). The requirements for certification of seed potatoes are set forth by H. L. Bolley.

Some rice breeding experiences, G. N. RANGASWAMI AYYANGAR (*Agr. Jour. India*, 16 (1921), No. 2, pp. 156-168, fig. 1).—Practical instructions are given regarding the breeding of swamp rice, dealing with plats, seed beds, and seeding, labeling, transplanting, flowering, selfing, roguing, and seed storage.

The beet-sugar industry in the United States in 1920, C. O. TOWNSEND (*U. S. Dept. Agr. Bul.* 995 (1921), pp. 58, pls. 10, figs. 2).—A revision of the material included in Department Bulletin 721 (*E. S. R.*, 40, p. 139.)

Identification of mangel seed in sugar beet seed, H. PIEPER (*Deut. Zucker-indus.*, 44 (1919), No. 47, pp. 560-562, figs. 2).—Seedlings grown under diffused light differed according to color of stem when three weeks old, red mangels possessing a reddish color on both exposed and underground portions of the stem,

¹Ann. Bot. [London], 21 (1907), pp. 57-60.

while yellow mangels were characterized by yellow or orange colored seedlings. Sugar beets remained colorless or else exhibited a pink hue. The seedlings of white mangels rich in sugar, such as Lanker Substantia, resembled those of sugar beets so closely as to preclude differentiation by this method.

A simple pollinating apparatus [for sugar cane], T. S. VENKATRAMAN (*Agr. Jour. India*, 16 (1921), No. 2, pp. 203-206, fig. 1).—The pollen is passed through fine meshed wire gauze to free it from pieces of broken anthers or stigmas and is subsequently loaded into gelatin capsules. The pollen-charged capsule is inserted in the end of a tube with a valved rubber bulb, and holes are made in each end of the capsule by a single puncture of a darning needle. When the bulb is pressed, a gentle spray, similar to that produced when a sugar cane arrow is shaken by the wind or gently tapped, emerges at the free end of the capsule and can be directed to any desired part of the arrow. The advantages of this apparatus are the absence of clogging and blowing back of pollen, and storage in sealed receptacles. Number and height of pollinations can be disregarded.

Tucuman seedling canes in 1920, W. E. CROSS (*Rev. Indus. y Agr. Tucumán*, 11 (1920), No. 5-6, pp. 57-62).—Further observations are recorded on sugar cane seedlings produced in Tucuman (E. S. R., 42, p. 533).

The culture of sugar cane in New South Wales, A. H. HAYWOOD (*N. S. Wales Dept. Agr., Farmers' Bul. 139* (1921), pp. 36, figs. 12).—Cultural and field practices profitable in the production of sugar cane in New South Wales are described, with notes on diseases and their control.

The culture and feeding of Russian sunflowers, G. R. QUESENBERRY, O. C. CUNNINGHAM, and L. FOSTER (*New Mexico Sta. Bul. 126* (1921), pp. 1-14, 19, 20, figs. 6).—Cultural operations, irrigation methods, and harvesting practices are suggested in brief for the production of Russian sunflowers in New Mexico. Feeding trials including sunflower silage are noted on page 169.

When Russian sunflowers were planted in hills 3 ft. apart with 3 plants per hill on ditch bank soils, the following acre yields were secured: Grassy clay 2 tons, waterlogged clay 1 ton, clean, friable clay 25 tons, waterlogged loam 5 tons, and clean, friable loam 30 tons. The plants on clean loam and clay were stockier, with more leaves and longer, denser branches than on other soil types. Plantings seeded before the soil was thoroughly warm made a slower and apparently woodier growth than later plantings. The rapid growth and dense shade produced by sunflowers were more effective in weed eradication than any other crop planted at the same time, indicating a possible means of eliminating Johnson grass.

Effect of frost and "soil stain" on the keeping quality of sweet potatoes, A. J. OLNEY (*Abs. in Science, n. ser.*, 54 (1921), No. 1390, p. 158).—In experiments at the University of Kentucky, vines were cut away from sweet potatoes before, immediately after, and five days after a freeze. When the potatoes were stored at a temperature of from 60 to 65° F., the losses of the three lots amounted to 4, 0, and 88 per cent, respectively. Potatoes badly affected with soil stain (*Monilochaetes infuscans*), but otherwise sound, sustained a loss of 55 per cent, while healthy checks lost only 12 per cent. Potatoes wrapped with paper suffered a loss of 20 per cent, compared with 12 per cent in those unwrapped.

Stocks of leaf tobacco, 1920 (*Bur. of the Census [U. S.], Bul. 146* (1921), pp. 53, fig. 1).—In addition to statistics of leaf tobacco held, this bulletin also includes tabular data showing the production, consumption, imports, and exports of tobacco, sales by growers and acreage prices obtained, the quantities of the

products manufactured therefrom, and the revenue on tobacco collected by the Federal Government, supplementing those noted previously (E. S. R., 44, p. 232).

White Burley tobacco in Canada, H. A. FREEMAN (*Canada Expt. Farms Bul.* 45, 2. ser. (1921), pp. 36, figs. 22).—Approved cultural and field practices for growing White Burley tobacco in Canada are described and curing and marketing methods are discussed. Notes are given on the control of diseases and insect pests.

History, culture, and curing of tobacco [in Spain], M. GONZÁLEZ RE-TUERTA (*Historia, Cultivo y Fermento del Tabaco. Granada: P. V. Traveset, 1917, pp. 114*).—A general discussion of cultural and curing practices followed in the production of tobacco in Spain, with brief historical notes.

Comparative vigor of F_1 wheat crosses and their parents, F. GRIFFEE (*Jour. Agr. Research [U. S.]*, 22 (1921), No. 2, pp. 53–63).—In studies at the Minnesota Experiment Station of the immediate effects of cross-pollination on seed weight and of the increased vigor of F_1 crosses, varieties of *Triticum vulgare* were crossed with each other and with Little Club (*T. compactum*), spring emmer (*T. diocum*), and Mindum (*T. durum*). Little Club was crossed also with spring emmer and Mindum.

An increase in seed weight was obtained in all varietal crosses as an immediate effect of cross-pollination. The only significant difference shown by immediate hybrids of specific crosses was a decrease in seed weight obtained in Velvet Chaff \times Mindum. In the F_1 generation some of the hybrids exceeded the parental average in height of the tallest culm, and in total culm length others showed a decrease. In all varietal crosses the F_1 hybrid exceeded the parental average in yield of grain per plant, 6 out of 8 crosses exceeding the yield of the better parent. Crosses between Little Club and varieties of *T. vulgare* gave results similar to those of crosses between vulgare varieties.

The F_1 generation of crosses of emmer or Mindum with varieties of *T. vulgare* or with Little Club showed a high degree of sterility. The average percentages of barren florets were 19 in the parental varieties, 15 in F_1 varietal crosses, including crosses of Little Club with vulgare varieties, 75 in vulgare-emmer and Little Club-emmer crosses, and 70 in durum-vulgare and durum-Little Club crosses.

Kanred wheat, J. A. CLARK and S. C. SALMON (*U. S. Dept. Agr., Dept. Circ.* 194 (1921), pp. 13, figs. 3).—An account of the history, characteristics, performance, and milling and baking value of Kanred hard winter wheat (E. S. R., 39, p. 539), with notes on the certification of the variety by the Kansas Crop Improvement Association and the Kansas Experiment Station. Comparative yields at the Kansas Station have been noted (E. S. R., 44, p. 224). The distribution of hard red winter wheat in the United States in 1919 is shown on an outline map.

Yields obtained at 18 stations in the western half of the United States during various periods from 1911 to 1920 indicate that wherever Turkey or Kharkof hard winter wheats are cultivated, Kanred can be grown with equal chances of success. The authors state that except in Washington, Oregon, Idaho, Montana, and northern Wyoming, this variety may be expected to produce higher yields than other hard winter wheats commonly grown. Kanred can not compete with the soft winter-wheat varieties on the lower lands or richer soil of eastern Kansas or in the eastern United States, and is not winter hardy enough to replace spring wheat in the northern Great Plains. The data so far obtained indicate that the quality of hard red winter wheat will be maintained with a widespread distribution of Kanred wheat throughout the hard winter-wheat section.

The influence of atmospheric variations on the weight of bagged wheat, F. B. GUTHRIE, G. W. NORRIS, and J. G. WARD (*Agr. Gaz. N. S. Wales*, 32 (1921), No. 3, pp. 200-202, pls. 2).—A bag of wheat, freshly harvested under hot and dry conditions and suspended from the roof of a laboratory at Sydney, was weighed daily during a period of about two years. A comparison of the graph of the weight variation with that of the daily humidity changes shows that at the outset of the experiment, the bag gained weight for about two weeks without responding to slight local atmospheric changes. From this time, however, any appreciable increase or decrease of humidity was followed by corresponding, although much smaller, increases or decreases in the weight of the wheat, with a maximum variation of 1.4 per cent.

Studies in crop variation.—I, An examination of the yield of dressed grain from Broadbalk, R. A. FISHER (*Jour. Agr. Sci. [England]*, 11 (1921), No. 2, pp. 107-135, figs. 5).—A study of the records of Broadbalk field at Rothamsted, where wheat was grown continuously under uniform treatment since 1852, showed three types of variation distinguishable in the wheat yield: Annual variation, steady diminution due to deterioration of the soil, and slow changes other than steady diminution. The relatively slow rates of decrement of plats receiving manure and heavy applications of nitrogen as compared with a plat receiving smaller amounts of nitrogen seemed to show a permanent advantage in very high nitrogenous dressings, and to emphasize the need for caution in the employment of the principle of diminishing returns. The influence of potassium sulphate and its substitutes, sodium sulphate and magnesium sulphate, was also evinced very strikingly.

"Average wheat yields, even over long periods, from different fields or for different seasons can not approach in accuracy the comparison of plats of the same field in the same seasons. . . . The effects of weather clearly require that the seasons should be identical, unless the series be very long, but the slow changes in mean yield show that even comparatively long series of different years from the same field can not be accurately compared. Within the same field, however, the slow changes have almost proportional effects, and comparison between the mean yields of neighboring plats may be made with great accuracy."

Seed marketing hints for the farmer, G. C. EDLER (*U. S. Dept. Agr., Farmers' Bul.* 1232 (1921), pp. 31, figs. 13).—Practical information concerning the preparation of seed for the market and the sale and purchase of seed. Outline maps indicate the counties of the United States which normally produce either a surplus, sufficient, or an insufficient quantity of seed of red clover, alfalfa, timothy, golden millet, amber sorgo, Sudan grass, cowpeas, and soy beans as compared with planting requirements. The average purity and germination tests of the best commercial grade of seed and the commonly accepted weights per bushel are tabulated.

Seed testing [in Scotland, 1919-20] (*Scotland Bd. Agr. Rpt.*, 9 (1920), pp. LX-LXIX).—The work of the Seed Testing Station at Edinburgh during the year ended June 30, 1920, is described as heretofore (*E. S. R.*, 44, p. 143). Notes are included on the purity and germination of the 9,451 samples of grass, clover, cereal, legume, forage, forest tree, root crop, and vegetable seed tested.

Newly recorded weeds, J. H. MAIDEN (*Agr. Gaz. N. S. Wales*, 32 (1921), No. 8, p. 580).—The appearance of *Amaranthus deflexus* and *Xanthium commune* in New South Wales is noted.

Common weeds and their control, J. G. FISKE (*New Jersey Stat. Circ.* 125 (1921), pp. 19, figs. 14).—A general discussion of weed control, with brief descriptions of common weeds.

Destruction of wild poppies in cereals, VILCOQ (*Jour. Agr. Prat.*, n. ser., 36 (1921), No. 31, p. 122).—Solutions of from 3 to 6 per cent of copper sulphate proved of little value for the eradication of wild poppies in wheat. The author prefers mechanical instead of chemical processes for the destruction of these weeds.

Stinkwort, A. J. PERKINS (*Jour. Dept. Agr. So. Aust.*, 24 (1921), No. 12, pp. 1068, 1069).—Heavy grazing with sheep in the early stages of growth is considered an effective method for eradicating stinkwort (*Inula graveolens*).

Fighting the water hyacinth, T. E. DABNEY (*Sci. Amer.*, 125 (1921), No. 15, p. 260, figs. 2).—The successful use of a live steam spray in the eradication of water hyacinth is described.

HORTICULTURE.

The effects of shading some horticultural plants, J. H. GOURLEY and G. T. NIGHTINGALE (*New Hampshire Sta. Tech. Bul.* 18 (1921), pp. 3-22, figs. 16).—Data are presented relative to the influence of shading on the growth of several horticultural plants, apple, peach, plum, strawberry, tomato, aster, snapdragon, geranium, and nasturtium. The experiments were conducted outdoors, shade being obtained by enclosing the plants in cloth-covered box-like structures, provided with ventilating facilities. Thermograph records indicated that both the diurnal and nocturnal air temperatures were higher within the shelter than outside. However, the soil temperature beneath the shade ranged below that of adjacent exposed areas. Measurements of light, as manifested by effect on photographic paper, indicated that the shading materially reduced the intensity.

Comparative observations on shaded and exposed plants showed that the leaves of the shaded plants were usually larger, thinner, flatter, more glabrous, and of a more intense green. The abscission layers of the leaf petiole were formed somewhat prematurely, causing the leaves to drop earlier than those of the check plants. The root system of the shaded annual plants was materially reduced. Flowering in a majority of the species was delayed by shading and in certain cases was entirely suppressed.

[Report of the] horticultural division, S. F. TOLMIE (*Canada Min. Agr. Rpt.*, 1920, pp. 53-55).—The following varieties of fruits and vegetables, originated by the division of horticulture, showed particular merit in 1919: Melba apple, a summer-fruiting seedling of McIntosh; Portia strawberry, on account of canning value and productivity; and Sweet Squaw corn, an early maturing variety of value for northern localities.

The culture of vegetables and flowers from seeds and roots, SUTTON and SONS (*London: Simpkin, Marshall, Hamilton, Kent & Co., Ltd.*, 1921, 16. ed., pp. [5]+462, figs. 26).—A compilation of useful information relating to general garden practices, including methods of controlling insect and fungus pests. The species of vegetables and flowers, alphabetically arranged in their respective groups, are discussed in reference to their special requirements.

Yield and quality in Hubbard squash, M. B. CUMMINGS and W. C. STONE (*Vermont Sta. Bul.* 222 (1921), pp. 3-48, pls. 2, figs. 7).—A study in the improvement of the Hubbard squash prompted by observations on ordinary commercial stocks which were found in many instances to have greatly deteriorated and to be protean in nature and quality. The problem resolved itself into four considerations: (1) To determine the possibility of projecting yield capability to the progeny, (2) to ascertain the influence of self, cross, and interpollination on quality and yield, (3) to study the effect of pruning and disbudding on yield, and (4) to ascertain the possibility of controlling quality.

Repeated selections from open-pollinated plants of high and low yielding strains over a six-year period, 1911 to 1916, showed the positive value of selection, in that after the first year the highs were superior to the lows in yields, ranging from 26 to 102 per cent, the maximum being attained in the fourth year. Neither self-pollination nor intercrossing was influential in controlling yield. Statistical studies of variations in weight per vine and per squash for the several methods of pollination and seed selection again showed, among other things, the insignificant effects of pollination. Pruning and disbudding had no influence in increasing the yield of ripe squashes nor in conserving the energies of the plant. Edibility tests of two good and two poor quality strains showed the possibility of projecting either good or poor quality to succeeding generations under conditions of experimental control. It is suggested that by means of self-fertilization and seed selection good quality can be promptly isolated and a desirable strain established.

Tomatoes for canning and manufacturing, J. H. BEATTIE (*U. S. Dept. Agr., Farmers' Bul. 1233 (1921), pp. 19, figs. 7*).—Following a discussion of the importance and location of the tomato-growing industry in the United States, the author presents practical information relative to general cultural features, including soils, fertilizers, varieties, growing young plants, setting in the field, tillage, spraying, and harvesting. Methods of sowing the seed and handling the seedlings are illustrated.

The California fruits and how to grow them, E. J. WICKSON (*San Francisco: Pacific Rural Press, 1921, 9. ed., rev., pp. 508, pls. 15, figs. 68*).—The subject matter of this edition has been fully revised in the light of current knowledge (*E. S. R.*, 42, p. 440).

Winter injury to fruit trees, W. H. CHANDLER (*Mass. Dept. Agr. Circ. 24 (1920), pp. 11*).—Following a discussion of several thermal and physiological factors involved in the killing of plant tissue by freezing, the author presents observations on winter injury in apple and pear orchards in New York, Vermont, Massachusetts, Indiana, and parts of Canada following the severe winter of 1917-18. A record is given of the behavior of several important apple and pear varieties. Severe pruning in the year preceding the freeze accentuated the severity of winter injury. The application of nitrate of soda and good tillage hastened recovery.

[**The Laurel experiments**], J. OSKAMP (*Ind. Hort. Soc. Trans., 1920 pp. 27-35*).—A comprehensive address, with discussion, on certain practical aspects of the soil management investigations at Laurel, Ind., the subject matter of which has been previously noted in a paper by the same author (*E. S. R.*, 44, p. 338).

Cost of producing apples in the Okanogan and average yields and prices for leading varieties, W. A. MIDDLETON (*Brit. Columbia Dept. Agr. Circ. 38 (1921), pp. 15*).—A report of a single season's survey (1919).

Nonproducing cider apple trees, A. TRUELLE (*Jour. Agr. Prat., n. ser., 35 (1921), No. 9, pp. 177-179*).—Pointing out that certain large, vigorous growing trees are sometimes found in the cider apple orchards of France which rarely bloom and never set fruit, the author suggests that this condition may be due to either of two causes, too strong vegetative growth or the inability of the blooms to self-pollinate. Girdling, root-pruning, resetting, and use of phosphoric acid and potash fertilizers are offered as possible remedies in the first instance, while dusting with the pollen of strongly self-fruitful varieties is proposed as a test for sterility. Top-working with scions of known merit is proposed as a last resort.

Thinning pear blooms, G. RIVIÈRE (*Jour. Soc. Natl. Hort. France*, 4. ser., 22 (1921), Oct., pp. 336, 337).—In order to study the effect of thinning on the set of fruits, in the spring of 1921 all but two blooms were removed from 80 clusters each of Bergamotte Esperen and Louise-Bonne d'Avranches pears. In comparing the number of resulting fruits with those of several control lots, it was found that no benefit accrued from thinning, greater, equal, and less numbers of fruits being recorded on the control branches.

The apricot in eastern Morocco, L. DUCELLIER (*Rev. Hort. Algérie*, 24 (1920), No. 3-5, pp. 45-61, figs. 4).—The author states that the apricot tree is very abundant and thrives extraordinarily well in eastern Morocco, but points out that, due to the current method of propagation, seedage, a multiplicity of varieties exist, yielding fruits of manifold colors, forms, and quality. One ancient tree with a trunk diameter exceeding one meter was noted.

Directions for blueberry culture, 1921, F. V. COVILLE (*U. S. Dept. Agr. Bul.* 974 (1921), pp. 24, pls. 29).—This is a revision of Bulletin 334 (E. S. R., 34, p. 534), and in like manner the principal feature is a presentation of methods of propagation, abundantly illustrated with photographs.

Grapes, F. W. FAUROT (*Missouri Fruit Sta. Circ.* 20 (1921), pp. 28, figs. 12).—Practical information is given relative to culture, pruning, propagation, and varieties, and the control of disease and insect pests.

Results of olive pruning experiments at Davis, F. T. BIOLETTI (*Fig and Olive Jour.*, 6 (1921), No. 4, pp. 6, 7, figs. 4).—An earlier report by the author and Flossfeder (E. S. R., 42, p. 833) indicated that a minimum amount of pruning favored the best development of the olive tree. In this article the author discusses the effect of pruning on the growth of Mission olive trees planted at Davis, Calif., in 1917, part of which were heavily winter pruned each year according to the usual commercial practice current at the time of the initiation of the test, part of which were heavily pruned each winter after the second year and part left unpruned.

Measurement taken when the trees were 4.5 years of age showed that the average height of the unpruned trees was a little over 3 ft. greater than that of the regularly pruned trees. The average diameter of the trunks of the unpruned trees was 7.5 as compared with 4.4 in. for the regularly pruned and 5.4 in. for those trees pruned after the second year. Furthermore, nearly every unpruned tree had commenced to bear fruit in the fifth year, whereas none of the pruned trees has borne a single fruit.

The composition of California lemons, E. M. CHACE, C. P. WILSON, and C. G. CHURCH (*U. S. Dept. Agr. Bul.* 993 (1921), pp. 18, figs. 4).—A report of investigations relative to color and thickness of peel, specific gravity, and oil and acid content of the fruits of three varieties of lemons from several important producing districts of California.

The data, largely presented in tabular form and representing observations recorded monthly during a period of one year, show that the specific gravity of lemons is higher in midsummer than during the winter months, decreases with an increase in thickness of the peel, and is higher in the Eureka variety than in either Lisbon or Villa Franca. No differences were discovered in the acid content of the three varieties. The Villa Franca contained more oil than the Eureka, and all varieties studied were found to have a higher oil content in the fall than in late winter and spring. No correlation was shown between color and thickness of peel, and no difference was noted in the composition of coast and inland-grown fruits of the same variety.

Nut culture in British Columbia, L. STEVENSON (*Canada Expt. Farms Bul.* 49, 2. ser. (1921), pp. 14, figs. 5).—Data are given relative to the propagation,

culture, varieties, and commercial value of various nut species in British Columbia. Particular attention is directed to the Persian or English walnut *Juglans regia*, detailed information being given relative to stocks, budding, and grafting. The average yields of 7 four-year old trees in 1918, 1919, and 1920 of two filbert varieties, Nottingham and Fertile de Coutard, found the most productive at the Vancouver Experimental Station, are given as 4.5, 1.4, and 7.8, and 4.5, 3, and 6.4 lbs., respectively. Lists of varieties under test at the station, grouped according to species, are included.

FORESTRY.

Ecological committee report on forestry survey (*Ill. Acad. Sci. Trans.*, 12 (1919), pp. 181-289, pls. 16, figs. 11).—The following papers are contained in this report: The Forest Lands of Jo Daviess County, by H. S. Pepoon (pp. 183-202); A Preliminary Report on the North Two Tiers of Sections in Niles Township, Cook Co., Ill., by W. G. Waterman (pp. 203-207); Ecological Survey of Forests in the Vicinity of Glencoe, Ill., by H. M. Schmoll (pp. 208-233); Preliminary Account of the Forests in Cumberland County, Ill., by A. G. Vestal (pp. 234-245); On the Forests of La Salle County, Ill., by G. D. Fuller and P. D. Strausbaugh (pp. 246-272); Strip Survey and Growth Studies in La Salle County, by R. B. Miller and G. D. Fuller (pp. 273-281); and The Forests of Vermilion County, by W. B. McDougall (pp. 282-289).

Report of the director of forestry for the fiscal year ended March 31, 1920, R. H. CAMPBELL ET AL. (*Canada Dept. Int., Rpt. Dir. Forestry*, 1920, pp. 40).—In continuation of previous reports (E. S. R., 43, p. 542), this is a record of the various activities of the forestry branch of the Canadian Department of the Interior for the fiscal year ended March 31, 1920. To this are appended several subreports, including those of the chief of the tree-planting division, the district inspectors of forest reserves for Manitoba, Saskatchewan, Alberta, and British Columbia, and the acting superintendent of the forest products laboratories of Canada.

Chinese forestry in 1919-20, J. S. REISNER (*Amer. Forestry*, 27 (1921), No. 334, pp. 656-659, figs. 8).—A progress report of forest activities in China for the year ended with the spring planting of 1920 (E. S. R., 44, p. 240). It is stated that practically all the large forestry enterprises in China are headed by Americans or American trained foresters.

Manual of forest rights, C. GUYOT (*Manuel de Droit Forestier a l'Usage des Particuliers Propriétaires de Bois*. Paris: Berger-Lévrault, 1921, pp. VII+341).—A small handbook relating to French forest laws and restrictions prepared for the use of owners of private forest areas.

The influence of the forest on the flow of water, A. ENGLER (*Mitt. Schweiz. Zentralanst. Forstl. Versuchsw.*, 12 (1919), pp. XV+626, pls. 49, figs. 4; *abs. in Centbl. Gesam. Forstw.*, 46 (1920), No. 11-12, pp. 337-359).—An exhaustive account of an investigation conducted in the Bern Canton, Switzerland, in which accurate records were taken of the flow of two streams, one draining a densely wooded (97 per cent) and the other a lightly wooded (30.9 per cent) area. The wooded area contained 55.79 hectares (137.8 acres), the partly wooded 69.71 hectares. The general slope and contour are described as similar.

The flow records supported by rainfall, snowfall, and temperature data indicated that, while the annual flows of the two streams were practically equal, the flow of the wooded stream was constant and much less influenced by droughts, thaws, and sudden heavy rainfalls. Studies indicated that the soil

of the wooded area was more porous, of higher water-holding capacity, and more penetrable than that of the partially denuded area.

The grassland of the Humboldt Mountains established since the burning of their forest covering, L. COCKAYNE (*New Zeal. Jour. Agr.*, 23 (1921), No. 3, pp. 137-147, figs. 6).—An account of an attempt to establish desirable pasturage following the burning of southern beech (*Nothofagus*) forests on a part of the Humboldt Mountains. Of the species sown, rye grass (*Lolium perenne*) and alsike (*Trifolium hybridum*) failed, but a sufficient number of species survived to lead the author to conclude that good grassland may be procured following fires if a proper seed mixture is sown and subsequent grazing controlled.

The durmast oak woods (*querceta sessiliflorae*) of the Silurian and Malvernian strata near Malvern, E. J. SALISBURY and A. G. TANSLEY (*Jour. Ecology*, 9 (1921), No. 1, pp. 19-38, pl. 1).—This contribution to the knowledge of the factors determining the dominance of *Quercus sessiliflora* in the British Isles presents a study of four soil types and their inhabiting flora, located near Malvern, England.

Of a total of 63 woody and 225 herbaceous species found, a great majority are normally in the quercetum sessiliflorae, although the most typical flora was located on a soil derived from May Hill sandstone. The presence of *Q. sessiliflora*, a naturally calciphobous species, on soils derived from calcareous rocks is explained by the results of chemical determinations, which indicated that the surface soils above the limestones are often lacking in calcium carbonate.

Studies in the germination of Norrland Scotch pine [*Pinus sylvestris*] seeds, E. WIBECK (*Meddel. Statens Skogsförsöksanst.*, No. 17 (1920), pt. 1-2, pp. 1-20, figs. 6).—A contribution from the Swedish Forestry Experimental Station, with German summary, presenting the results of miscellaneous experiments with Scotch pine seeds.

In plotting the records of a viability test of seed from several forests of middle and northern Sweden upon an outline map of that country, the author noted a definite grouping, in accordance with certain geographical areas. It was found that temperature was the determining factor, a mean temperature of at least 13° C. (55.4° F.) for June, July, and August being apparently necessary to secure a germination of over 50 per cent.

In a study of the effect of age on viability of 25 lots of seed tested for germination in 1915 and again in 1918, 16 showed a gain and 9 a loss in viability as a result of the three years' storage. A further study of the effect of age on viability conducted with two lots of seed, one grown under unfavorable conditions at an elevation of 397 meters (1,302 ft.) and the other in a more favorable situation at 302 meters, showed an increased germination following one year's storage, especially in the instance of the seeds produced at the higher altitude. These results led the author to conclude that delayed maturity is present in Norrland Scotch pine seeds, particularly in those grown at high altitudes under unfavorable soil conditions. It is suggested that the embryo of such seeds apparently requires considerable time to attain maturity after separation from the mother tree.

Influence of the period of transplanting western white pine seedlings upon their behavior in nursery and plantation, E. C. ROGERS (*Jour. Agr. Research [U. S.]*, 22 (1921), No. 1, pp. 33-46, figs. 7).—This is a study by the Forest Service, U. S. Department of Agriculture, of the influence of the time of transplanting young coniferous trees, *Pinus monticola*, on the percentage of loss due to heaving, based on investigations conducted at the Savenac Nursery, Haugan, Mont., and in the experimental field near Wallace, Idaho.

Four plantings of 1-year-old seedlings, August 15, September 1 and 15, and October 10, 1913, were found on the following spring to have suffered severe loss from heaving, the greatest loss occurring with the later transplants. A test in the spring of 1914 included nine plantings at approximate 10-day intervals, commencing April 24, and, although it was found that the seedlings could be transplanted successfully even as late as early July, it was evident that, on account of summer droughts usually obtaining at Haugan, April and early May was the best period for transplanting yearlings.

Records taken in September, 1916, and November, 1917, on 100 plants from each of the above nine lots, set in the open near Wallace on October 6, 1915, showed that the largest average height growth and highest percentage of living plants were present in the lot originally transplanted on June 30, 1914. This indicated that the date of the original transplanting has little influence upon field-set trees.

The value of bark examination in connection with improvement thinings, C. A. GEHLEN (Arch. Rubbercult. Nederland. Indië, 5 (1921), No. 9, pp. 453-464).—The need of a satisfactory and reliable means of selecting the most productive trees at the time of thinning plantations of *Hevea brasiliensis* led to a comparison of two methods. One was the actual measurement of the latex yield and the other an anatomical study of the latex vessels in the bark. The two were found equally reliable, and since the bark examination is much more rapid and less costly the author considers it to be the more satisfactory method. An English summary is appended.

Anatomical characters and identification of Formosan woods, with critical remarks from the climatic point of view, R. KANEHIRA (*Taihoku, Taiwan: Bur. Productive Indus.*, 1921, pp. 2+317, pls. 50, fig. 1).—A contribution in English from the Formosa Forest Experiment Station, presenting an anatomical study of the secondary wood of 386 Taiwan (Formosan) species, comprising 226 genera and 66 families. An analytical key, based on the studies, is offered as an assistance in the identification of the woods. Micrographs of 300 species are included. In an attempt to correlate anatomical differences with climatic variations, many Philippine and Japanese species were also examined, and a table is included giving a general comparison of the three floras.

Identification of the important Japanese woods by anatomical characters, R. KANEHIRA (*Taihoku, Taiwan: Bur. Productive Indus.*, 1921, pp. [II]+104, pls. 9).—A work, similar to the above and offered as a supplement, embracing 38 families, 104 genera, and 181 species, mostly from Japan proper, with a few from Saghalien and Hokushu.

Figure in wood, S. J. RECORD (*Amer. Forestry*, 27 (1921), No. 334, pp. 611-617, figs. 15).—An illustrated article pointing out the wide variations of figures and colors in many wood species, and presenting information relative to the source and cause of figuration and the most effective methods of sawing to emphasize desirable markings.

DISEASES OF PLANTS.

Report of provincial plant pathologist, J. W. EASTHAM (*Brit. Columbia Dept. Agr. Ann. Rpt.*, 14 (1919), pp. 41-44).—A raspberry yellow rust (*Phragmidium imitans*) which is said to differ considerably from the so-called orange rust (*Gymnoconia interstitialis*) did not, in 1919, cause as much injury as was expected. Raspberry cane blight (*Leptosphaeria coniothyrium*) injury is ascribed largely to physical conditions. Raspberry anthracnose (*Gloeosporium venetum*) appears to be on the increase. Crown gall of the canes has also been observed on loganberry.

Bacterial blight (*Pseudomonas juglandis*) of walnut, said to be the most serious enemy of walnut interests in the Pacific States, is said to be present near Vancouver but not to have been reported from the interior.

Western tomato blight caused much loss to growers in parts of southern Okanogan. The disease appears to be due to a fungus in the soil which attacks at the root injuries sustained in transplanting. Some plants show high resistance to the disease.

Apple-tree anthracnose has been successfully controlled by spraying during the past three years. Bordeaux mixture effects disappear during storage, this fruit showing less rot than those not so sprayed. Apple powdery mildew appears to be controllable by use of 1:40 lime-sulphur spray.

Late spraying for potato late blight was ineffective. Seed selection is necessary to control *Fusarium*.

The comparative resistance of varieties of oats to crown and stem rusts, L. W. DURRELL and J. H. PARKER (*Iowa Sta. Research Bul. 62 (1920), pp. 27-56d, figs. 13*).—The authors give the results of a study in cooperation with the Bureau of Plant Industry, U. S. Department of Agriculture, of about 200 forms of oats representing different species, varieties, and hybrids to determine the degree of infection by crown and stem rusts. Field and greenhouse experiments were made, different methods of inoculation being followed, and the results indicate that the ratio between the amount of infection and the number of viable spores applied to a susceptible host is direct when a small number of spores is applied, but that with large numbers this ratio is not maintained. The incubation period on seedlings was found to be two days less than on half grown or older plants.

In studying the different varieties resistant to rust in field and greenhouse, the authors found that, while the results were comparable, they were more marked in the field. In the case of crown rust, only a few varieties showed a high degree of resistance, the majority ranging between 25 and 70 per cent of infection. The species *Avena barbata* was the most resistant to crown rust. A number of other outstanding varieties were observed. In the greenhouse *A. sterilis* showed more resistance to crown rust than *A. sativa*. More varieties of oats were found to be resistant to crown rust than to stem rust, though very few were entirely resistant to crown rust when subjected to a severe epidemic.

Under the conditions of the experiment, the species *A. barbata* and the varieties Green Russian and Ruakura were the only oats evidencing marked resistance to both species of rusts. During the progress of the investigations it was found that crown rust infection is greater on the earlier sown oats, while stem rust infection is slightly greater on the later seedlings.

Aecial stage of the orange leaf rust of wheat, *Puccinia triticina*, H. S. JACKSON and E. B. MAINS (*Jour. Agr. Research [U. S.], 22 (1921), No. 3, pp. 151-172, pl. 1, fig. 1*).—Some results are given of an investigation of wheat, rye, barley, corn, and related grasses, carried on cooperatively between the Bureau of Plant Industry, U. S. Department of Agriculture, and the Indiana Experiment Station. The present paper reports investigations on the aecial stage of the orange leaf rust (*P. triticina*), which has been produced in greenhouse cultures on several species of *Thalictrum*. The various species of *Thalictrum* were found to show varying degrees of susceptibility to the rust, and the fungus is apparently limited to species of *Thalictrum*, no infection having been obtained upon other species of Ranunculaceae or upon plants of other families investigated. On account of the morphology and host relationships, *P. triticina* is considered closely related to *P. persistens*, *P. alternans*, *P. oblitterata*, *P. elymi*, and *P. agropyri*, but it is separable from these rusts by its sharp biologic limitation to wheat.

From the fact that it is limited to wheat, which is an introduced host, and because the most susceptible species of *Thalictrum* which serve as aecial hosts also are exotic, the authors consider *P. triticea* to be of foreign origin.

Take-all of wheat and its control, H. B. HUMPHREY ET AL. (*U. S. Dept. Agr., Farmers' Bul. 1226 (1921), pp. 12, figs. 6*).—A popular account is given of a disease designated as take-all which was discovered in Illinois in April, 1919, and later found in other portions of that State and in Indiana. More extensive investigations seem to indicate that this disease differs from the disease known in Australia as take-all. There seems to be some evidence showing that a fungus, *Helminthosporium* sp., may be closely associated with the advanced stages of the trouble. Considerable differences are reported in the resistance and susceptibility of varieties to this disease, and the most satisfactory means of control is believed to be the discarding of the susceptible varieties in localities where the disease occurs and using only the resistant sorts.

Heat injury to beans in Colorado, H. G. MACMILLAN and L. P. BYARS (*Phytopathology, 10 (1920), No. 7, pp. 365-367, fig. 1*).—Attention is called to an injury to beans in June, 1919. During the early part of the month the temperature fell to 29° F., and at the end of the month high temperature was reached for a few days, the maximum air temperature being 104°. The cold weather had necessitated the reseeded of considerable areas, and following the period of high temperature many of the bean seedlings were found to have shrunk at the ground line and collapsed. Data are presented which indicate that the soil temperature was much higher than the air temperature, and it is believed that the beans were exposed to a temperature of 130° or higher for 2 or 3 hours each day for several days.

The white lesions on stems of conifers, cowpeas, etc., reported by Hartley (*E. S. R., 40, p. 53*), have not been observed on the beans in Colorado.

Onion diseases and onion seed production, C. W. EDGERTON (*Louisiana Stas. Bul. 182 (1921), pp. 3-20, figs. 9*).—The author reports serious losses of onions, particularly the seed crops, in portions of the Gulf region of southern Louisiana, usually about 50 per cent of the crop being destroyed.

An investigation was made, and a number of fungi were found to be actively participating in the losses. The principal organism present on the plants was *Macrosporium parasiticum*, the cause of the black stalk rot. Besides this fungus *Peronospora schleideniana*, which causes a mildew of onions, *Colletotrichum circinans*, *Botrytis* sp., *Fusarium malli*, and another species of *Fusarium* were found. The black stalk rot fungus is said to follow the attack of the mildew and a white-spot disease which is thought to be physiological in nature.

Spraying experiments for the control of these troubles have not given very satisfactory results, and it is believed that the applications should be made more frequently than at weekly intervals.

Investigation of potato diseases, P. A. MURPHY (*Canada Expt. Farms Bul. 44, 2. ser. (1921), pp. 86, figs. 35*).—Some of the results are given of investigations made on a number of potato diseases of common occurrence in Canada, special attention having been given to the relation of climate and environment to the severity of the disease. The symptoms, distribution, causes, sources of infection, and methods of control, where definite means are known, are given for late blight, blackleg, leaf roll, mosaic, and curly dwarf and related diseases.

For protection against late blight (*Phytophthora infestans*), thorough spraying is said to have given satisfactory results. Special attention was given to the tuber rot phase of late blight, and the author claims that the danger of late blight rot originating from the foliage and surface soil during digging is greater

than that occurring while the potatoes are in the ground. The surface soil is said to be a more serious source of infection at harvest time than partly blighted foliage, and infection may be caused by soil for at least nine days after the stalks have been removed. Late blight rot, it is claimed, can be reduced considerably by the removal of the foliage for a sufficient period, probably not less than two weeks, before harvesting. Where blight appears late in the season on potatoes which have been previously healthy, and where it is believed the tubers are still free from infection, there is said to be good indications that the safest course to follow is to remove the stalks and not dig the crop for at least two weeks. This practice is said to be new, and it is desired that experimentalists should give it a trial in conjunction with the best spraying possible.

For the control of the blackleg disease, due to *Bacillus atrosepticus*, seed selection and treatment are recommended. For leaf roll and mosaic diseases, selection of tubers and growing seed tubers on special seed plats are suggested as means of eliminating losses due to these causes.

Under the heading of curly dwarf and related diseases, the author describes several types that he believes can be segregated from the complex usually designated as curly dwarf. Among the forms described are typical curly dwarf, crinkle, leaf drop, and streak.

Ormskirk potato trials, J. SNELL and E. JOHNSON (*Min. Agr. and Fisheries [London]*, *Misc. Pub.* 28 (1920), pp. 55, pls. 3).—The annual report for 1919 of the trials of potato varieties for immunity to wart disease deals comprehensively with the various phases of the main, subsidiary, and related subjects, including named varieties tested at Ormskirk, 1915–1919, and here listed as immune, susceptible, or doubtful.

Blackleg potato tuber rot under irrigation, M. SHAPOVALOV and H. A. EDSON (*Jour. Agr. Research [U. S.]*, 22 (1921), No. 2, pp. 81–92, pls. 6).—In a contribution from the Bureau of Plant Industry, U. S. Department of Agriculture, the authors describe a bacterial field disease of potato tubers that is said to prevail in certain irrigated sections of the West. While isolations made from tubers have shown in many cases the presence of fungi, bacteria were present in all cultures. Subsequent investigation showed that the rot in question was due to a species of bacteria, which is recognized as *Bacillus phytophthorus*. This organism is claimed to be pathogenic to the potato, and inoculations of healthy stems or tubers with pure cultures produced a rapid, soft decay of stems or a tuber rot.

Under field conditions in certain irrigated sections of the West, certain varieties of potatoes exhibited a blackleg tuber rot which is not typical of the disease as manifested in the Eastern States. The external appearance of the rot is said to become specially confusing when the affected areas of the tuber dry up and shrivel in storage.

Temperature and humidity studies of some Fusaria rots of the Irish potato, R. W. GOSS (*Jour. Agr. Research [U. S.]*, 22 (1921), No. 2, pp. 65–80, pls. 2).—In a contribution from the Nebraska Experiment Station, the author reports experiments conducted to determine the relation of temperature and humidity to the progress of potato tuber rots caused by Fusaria.

Fusarium oxysporum, *F. trichothecioides*, and *F. radiculicola* were all found capable of producing a rot of the potato tuber. In pure cultures the amount of growth of all three species of organisms was about equal at 25° C., *F. oxysporum* and *F. radiculicola* increasing in growth up to 30°, where they produce their maximum growth. The growth of *F. trichothecioides* decreased above 25°, and at 30° very little or no growth was found to take place. Experimental infection of tubers was produced with all three organisms under

various conditions of temperature and relative humidity. A temperature of 25° was found favorable for the production of a tuber rot by all the species. *F. oxysporum* grew more rapidly and produced a more extensive rotting than the other two species at a temperature of 16° and above. *F. trichothecioides* was capable of producing a rot at lower temperatures than the others, in some cases the rotting being produced at a temperature of 5°.

Relative humidity was found to play an important part in determining the progress of tuber rots, and it had about the same influence on all three species. All the species of *Fusaria* investigated were found to live and sporulate at temperatures as low as 9°, with low relative humidities, but they were not capable of producing rots under such conditions.

The author calls attention to the desirability of giving consideration to moisture as well as temperatures where incipient rot occurs in stored tubers. It is believed probable that a rotting of the tubers initiated at high temperatures and high relative humidities could be completely checked by submitting the tubers to lower temperatures and lower humidities.

Potato leaf roll, J. G. O. BOTJES (*Die Blattrollkrankheit der Kartoffelpflanze. Inaug. Diss., Landw. Hochsch., Wageningen, 1920, pp. 16, pls. 8*).—Presentation is made in very condensed form of the results of studies on leaf roll carried out at Wageningen in 1920.

The primary stage of leaf roll (original infection) is easily mistaken for somewhat similar but unrelated leaf abnormalities. The second stage, however, is too characteristic to be mistaken. This develops as a result of the infection being present in the mother tuber. The symptoms as detailed show the presence of an infecting agent which has not yet been isolated.

Soy bean mosaic, M. W. GARDNER and J. B. KENDRICK (*Jour. Agr. Research [U. S.], 22 (1921), No. 2, pp. 111-114, pls. 2*).—In a contribution from the botany department of the Indiana Experiment Station, the authors give a description of a disease of soy beans observed in August, 1920, in a small field of Holbrook soy beans at the station. The symptoms on the soy beans were typical of mosaic disease. The affected plants were stunted, petioles and internodes shortened, the leaflets misshapen, and the pods stunted and flattened, and the yield of seed was materially reduced. Field inoculations carried on gave negative results, but other tests showed that the disease might be transmitted through the seed, and greenhouse inoculations finally gave symptoms of the disease, which became evident only on the young leaflets. Attempts to transfer the disease to garden peas and cowpeas gave negative results.

A dry-rot canker of sugar beets, B. L. RICHARDS (*Jour. Agr. Research [U. S.], 22 (1921), No. 1, pp. 47-52, pls. 6*).—The author describes investigations of a root rot of the sugar beet conducted at the Utah Experiment Station. The disease investigated was first called to his attention in August, 1920, when specimens of the diseased beets from Cornish, Utah, were examined and found to exhibit numerous brown, circular lesions which varied from $\frac{1}{8}$ to 1 in. in diameter. The outer surface of the root covering these lesions had in most cases remained entire, but had so sunken as to give a definite contour of alternating light and dark brown concentric areas or rings. Beneath the outer layer of cells a mycelium was present, which upon investigation proved to be the *Rhizoctonia* stage of *Corticium vagum*.

During the season studies were made of a large number of beets from a number of fields in which the dry-rot had been found, and all the characteristic cankers exhibited the sterile stage of this fungus. Inoculation experiments indicated that the disease could be produced by artificial means, and it is though probable that the sugar beet root aphid and other insects may have

an important function in the preliminary entrance of the fungus to the beet root.

Gumming disease of sugar cane in Porto Rico, J. MATZ (*Phytopathology*, 10 (1920), No. 9, pp. 429, 430, fig. 1).—The author reports the occurrence in cane fields in Porto Rico of the gumming disease of sugar cane due to *Bacterium vascularum*. The disease is believed to have only recently appeared, but it was found attacking the oldest varieties of cane grown in the island.

A Macrosporium foot rot of tomato, J. ROSENBAUM (*Phytopathology*, 10 (1920), No. 9, pp. 415-422, figs. 4).—A detailed account is given of investigations previously reported (E. S. R., 44, p. 647).

Turnip mosaic, M. W. GARDNER and J. B. KENDRICK (*Jour. Agr. Research* [U. S.], 22 (1921), No. 3, pp. 123, 124, pl. 1).—In a contribution from the Indiana Experiment Station, the authors describe a typical mosaic disease of turnip first observed in a small field of turnips near South Bend, Ind., in October, 1920. Inoculation experiments were carried on with turnip and radish seedlings, and characteristic mosaic symptoms were readily produced on the turnips but not on the radish plants.

A transmissible mosaic disease of Chinese cabbage, mustard, and turnip, E. S. SCHULTZ (*Jour. Agr. Research* [U. S.], 22 (1921), No. 3, pp. 173-178, pls. 4).—In a contribution from the Bureau of Plant Industry, U. S. Department of Agriculture, the author gives a description of a transmissible mosaic disease occurring on Chinese cabbage, mustard, and turnip. Evidence is presented bearing upon the nature of the disease, its symptoms, and means of transmission.

The apple blotch and bitter rot cankers, J. W. ROBERTS (*Phytopathology*, 10 (1920), No. 7, pp. 353-357).—A discussion is given of the apple blotch canker caused by *Phyllosticta solitaria* and the bitter rot canker due to *Glomerella cingulata*.

It is claimed that in general the apple blotch canker does little serious damage in orchards that receive several sprayings during the year. In poorly kept orchards and with susceptible varieties considerable damage may be done. The blotch canker first appears as a raised, black, blister-like spot on a twig or water sprout of the current year's growth. As the twig or water sprout matures, the canker becomes lighter colored and finally, in its second year, assumes a light tan color with a dark border denoting the extent of the second year's growth.

Infection takes place only on the young branches of the current year's growth. During the year in which infection takes place and in the earlier part of the following year, the fungus is apparently actively parasitic, and during the first year it appears to make some growth during the dormant season of the host. Toward the end of the second season and especially in subsequent seasons, the fruiting bodies of other fungi are abundant in the canker, but *P. solitaria* is absent. It is believed that the tissues of the host have changed so that they are able to resist further invasion by the fungus causing the blotch canker. In orchards that are regularly sprayed, the cankers gradually decrease in number until the trees are nearly free from them. The spraying prevents the formation of new cankers, and the older ones, in which the fungus has died, heal over.

The apple bitter rot canker is said to do slight damage to trees except in the case of very susceptible varieties, but its connection with bitter rot of the fruit makes it of special interest. The bitter rot canker begins by lodgment of the spores of the fungus in a wound or in dead areas, and if conditions are favorable, subsequent infection takes place very rapidly. When the canker ceases to increase in size, a layer of callus forms at the margins of the canker,

which by midsummer of the following year has isolated the cankered portions of the bark. In this way further growth of the canker is usually prevented. The fungus lives and fruits in isolated cankers during the first and second years, but during the third year is dead and the callous layer has nearly closed over the wound.

Inoculation experiments carried on by the author have shown that there is considerable difference in the susceptibility of different varieties to infection, and that while the cankers on young, vigorous twigs or water sprouts are usually healed over by the third year and are chiefly dangerous as infection sources during the second year, in the case of older, slow-growing branches there is not the same vigorous development of callus and the canker may be relatively long-lived.

Bitter rot cankers are most easily found during the dormant season when they are not concealed by foliage, or at the time when the first infections appear on the fruit. When present, cankers may often be found just above clumps of the earliest affected fruits.

Apple scald: Its cause and prevention, C. BROOKS (*Better Fruit*, 15 (1920), Nos. 6, pp. 24-26; 15 (1921), No. 7, pp. 11, 12).—This address dealt chiefly with features and factors noted in the course of a study of apple scald, regarding which previous contributions have been noted (E. S. R., 42, p. 343).

The causation of scald proved evasive, but it was found that fruit wrappers saturated with fat or oil gave almost perfect protection against this injury. Spraying oil on apples caused injury where drops remained on the skin, but wiping prevented this injury, though tried only for one season.

Cacao disease [in Ecuador], R. HUNNEUS (*Bol. Asoc. Agr. Ecuador*, 1 (1920), No. 2, pp. 19-22).—Items of information are given, with opinions, regarding a cacao pod disease, possibly due to a fungus noted as abundant in connection therewith.

Citrus diseases in Porto Rico, J. A. STEVENSON (*Rev. Agr. Puerto Rico*, 3 (1919), Nos. 5, pp. 25-49; 7, pp. 25-32; 4 (1920), Nos. 1, pp. 31-38; 3, pp. 34-46; 4, pp. 25-36; 5, pp. 22-27; 6, pp. 9-19).—A general account of citrus culture in Porto Rico as affected by conditions refers particularly to the problems presented by diseases, a number of which are dealt with in somewhat systematic detail in connection with their causes and appropriate preventive or remedial measures. A bibliography includes about 20 titles. An appendix deals with the preparation and composition (also dilution) of sprays. Another lists injurious fungi.

Pythiacystis and Phytophthora, H. S. FAWCETT (*Phytopathology*, 10 (1920), No. 8, pp. 397-399).—A brief note is given to correct as far as possible any confusion which might have arisen regarding the distribution of *Pythiacystis citrophthora* as stated by the author in a previous publication (E. S. R., 33, p. 550). From a review of the subject and additional study he concludes that most of the cultures so far made from fruit and from diseased bark of one type of gummosis of citrus in California appear to be *P. citrophthora*. In only one instance has *Phytophthora terrestris* been found on citrus in California. Cultures made from diseased bark specimens in Florida, Cuba, the Isle of Pines, and Argentina appeared to have been *P. terrestris*.

Die-back of Coffea arabica in Uganda, W. SMALL (*Uganda Dept. Agr. Circ.* 4 (1920), pp. 25, pls. 4).—An account is given of the history of Uganda coffee and of coffee die-back, of laboratory methods of studying this disease, and of results and conclusions obtained.

It is concluded that in large-scale die-back, physiological factors are chiefly important, fungi being so in small-scale die-back. Hemileia causes a progres-

sive weakening of the plant, decreasing yield, and favoring susceptibility. *Colletotrichum*, *Phoma*, and various insects are supposed to play a part.

A Pestalozzia producing a tumor on the sapodilla tree, N. A. BROWN (*Phytopathology*, 10 (1920), No. 8, pp. 383-394, figs. 5).—The author describes tumors of various sizes occurring on the sapodilla tree growing in Dade County, Fla. From one of the outgrowths a *Pestalozzia* was isolated, and inoculations into young sapodilla trees produced slow-growing tumors, from which the fungus was reisolated. Small galls were also produced on the balsam fir and olive with cultures of this organism, and larger ones on the mango, but inoculations into larch, hemlock, and blue spruce produced no tumors, although there was blighting of the leaves.

The fungus isolated is said not to agree with *P. tumefaciens*, which produces tumors on different species of *Abies*, nor with the *Pestalozzia* known to produce tumors on different species of willow. It agrees in some respects with *P. funerea*, which is a parasitic species, but one not known to produce galls. The author has given to the fungus the name *P. scirrofaciens* n. sp., and a technical description of the organism is given. It is said that the disease can be controlled in orchards by destroying the infected trees.

Shoe-string root rot of Rhododendron and Azalea caused by Armillaria mellea, H. SCHMITZ (*Phytopathology*, 10 (1920), No. 7, p. 375, fig. 1).—A report is given of an extreme case of root rot of *Rhododendron* and *Azalea* caused by this fungus in the northwestern part of the United States. Specimens examined showed that the root systems were almost completely enveloped by rhizomorphs of *A. mellea*, and by the following spring nearly all the shrubs had been killed.

Note on resistance of chestnut to the blight, J. F. COLLINS (*Phytopathology*, 10 (1920), No. 7, pp. 368-371, figs. 2).—Attention is called to sprouts of chestnut trees which have been under observation in Lancaster County, Pa., since 1912. Some of these sprouts have attained a height of 16 ft. and are more than 1 ft. in circumference 1 ft. from the ground. The sprouts showed that the blight had been present but that the wounds were nearly healed over in 1919. At least three places on the main stem were found where the disease was formerly present but is now apparently absent, and the foliage of the crown appeared to be normal. The author considers the fact that a badly diseased sprout but little more than 1 in. in diameter should survive 7 years and increase in diameter is worthy of note.

Observations on the distance of spread of aeciospores and urediniospores of Cronartium ribicola, W. H. SNELL (*Phytopathology*, 10 (1920), No. 7, pp. 358-364).—The results are given of an investigation carried on in New York in 1918 and in Minnesota in 1919 on the natural infections on pines and *Ribes* under normal conditions. As a result of the investigation it was found that the aeciospores of *C. ribicola* can be blown more than 1.25 miles and infect *Ribes*. Dry weather prevented a wide distribution of the disease by urediniospores during the summer of 1918 in New York.

Notes on Peridermium harknessii, G. G. HEDGCOCK and N. R. HUNT (*Phytopathology*, 10 (1920), No. 8, pp. 395-397).—Notes are given of *P. harknessii*, the gall-producing form of *Peridermium* which is the aecial stage of *Cronartium coleosporioides*. As a result of observations it is believed that rodents assist materially in the spread of the fungus. Inoculation experiments were made on a number of species of pine, seven of which were infected and four were not. *P. harknessii* is said to have been collected in nature on five species of pine.

Note on the pathological effects of blazing trees, J. R. WEIR (*Phytopathology*, 10 (1920), No. 7, pp. 371-373).—Notes are given on the examination of a

large number of blazes made in forests in Montana and Idaho to determine the relation of the blazes to the entrance or exit of cull-producing fungi. Sporophores of the following species of fungi have been found: *Trametes pini*, *Fomes pinicola*, *F. laricis*, *Hydnum* sp., *Echinodontium tinctorium*, and *Pholiota adiposa*. Classification was made of the different species of conifers examined, and on the basis of resin secretion from blazes, conifers were classified as resinous and nonresinous. It was found that blazes in nonresinous species are more prolific sources of sporophore production than in resinous species.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

Directory of officials and organizations concerned with the protection of birds and game, 1921, G. A. LAWYER and F. L. EARNSHAW (*U. S. Dept. Agr., Dept. Circ. 196* (1921), pp. 20).—This is the usual annual directory.

Game laws for 1921, G. A. LAWYER and F. L. EARNSHAW (*U. S. Dept. Agr., Farmers' Bul. 1235* (1921), pp. 80).—This is the twenty-second annual summary of Federal, State, and Provincial statutes.

Laws relating to fur-bearing animals, 1921, G. A. LAWYER and F. L. EARNSHAW (*U. S. Dept. Agr., Farmers' Bul. 1238* (1921), pp. 32).—This is the annual summary of laws in the United States, Canada, and Newfoundland relating to trapping, open seasons, propagation, and bounties.

The small mammals of Colorado, E. R. WARREN (*Colo. Mountain Club Pub. 7* (1921), pp. 31, figs. 21).—A brief popular summary of information.

The destruction of gophers, B. LAWTON (*Alberta Dept. Agr. [Pamphlet, 1921], pp. 7, figs. 3*).—The gopher and the western spermophile are said to be the most destructive mammals attacking growing crops in the Province of Alberta. Brief accounts are given of three varieties of spermophiles and a gopher found in the Province and means for their control.

Life histories of North American gulls and terns: Order Longipennes, A. C. BENT (*U. S. Natl. Mus. Bul. 113* (1921), pp. X+345, pls. 93).—The work here presented on the life histories of North American birds is in continuation of that commenced in Bulletin 107, previously noted (*E. S. R.*, 41, p. 660). The same general plan has been followed, and the same sources of information have been utilized.

The birds of the British Isles and their eggs, T. A. COWARD (*London and New York: Frederick Warne & Co., Ltd., 1920, 2. ser., pp. VII+376, pls. 159*).—This second series by the author (*E. S. R.*, 44, p. 248) comprises the families Anatidae to Tetraonidae. Many of the illustrations presented are in colors.

Two new genera of nematodes, with a note on a neglected nematode structure, M. C. HALL (*U. S. Natl. Mus. Proc., 59* (1921), pp. 541-546, figs. 2).—The genera *Oslerus*, with *Filaria osleri* Ceb. as the type species, and *Hyostrongylus*, with *Strongylus rubidus* H. and S. as the type, are erected.

Synopsis of the trematode family Heterophyidae, with descriptions of a new genus and five new species, B. H. RANSOM (*U. S. Natl. Mus. Proc., 57* (1921), pp. 527-573, figs. 33).

Tularaemia Francis 1921 (*Pub. Health Rpts. [U. S.], 36* (1921), No. 30, pp. 1731-1753).—This subject is dealt with in three separate papers:

I. *The occurrence of tularaemia in nature as a disease of man*, E. Francis (pp. 1731-1738).—Seven cases of the disease due to *Bacterium tularense*, which were investigated clinically and culturally by the author in Millard County, Utah, in 1919 and 1920 and one of which resulted fatally, are reported. The coexistence in the same locality of tularaemia in man and in jack rabbits was proved by Francis in the summer of 1920, when *B. tularense* was isolated from 17 of 556 jack rabbits shot and dissected. One of 277 ground squirrels (*Citellus mollis*) examined was also found to be affected with tularaemia.

II. *Experimental transmission of tularaemia by flies of the species Chrysops discalis*, E. Francis and B. Mayne (pp. 1738-1746).—The experiments with *C. discalis* here reported show that specimens which have first bitten infected guinea pigs and tame rabbits in the laboratory can by their subsequent bites convey that infection to healthy guinea pigs and tame rabbits which they are allowed to bite, thus indicating that it is capable of carrying *B. tularensis* from infected jack rabbits to man. Injection tests showed that flies remained quite constantly infected up to five days and may be so up to 14 days, indicating that the virus does not multiply within the fly but that the fly acts merely in a mechanical way as a transmitter.

III. *Experimental transmission of tularaemia in rabbits by the rabbit louse, Haemodipsus ventricosus* (Denny), E. Francis and G. C. Lake (pp. 1747-1751).—"The transmission of tularaemia was effected in 20 out of 29 attempts through the agency of the common rabbit louse *H. ventricosus*, by the transfer of lice from rabbits dead of tularaemia to the hair of healthy rabbits, the intervals elapsing between infestation of the healthy rabbits and their deaths varying from 8 to 26 days, the average being 12.5 days. The intervals between the removal of lice from the infected animals and their application to the healthy animals were in all successful attempts not over three hours, with three exceptions, in which the interval was 2, 3, and 3 days, respectively. Transmission of tularaemia was effected through three successive series of rabbits by transfer of lice to each succeeding series from the preceding series.

"The practical importance of this experimental transmission of tularaemia from infected rabbits to healthy rabbits by the rabbit louse *H. ventricosus* is that it offers an explanation of the means by which the infection is kept alive throughout the year in the jack rabbits of Utah. Proof is at present complete that these jack rabbits are infested with lice, four specimens of *H. ventricosus* having been received from that source in July, 1921."

Applied entomology—an introductory textbook of insects in their relations to man, H. T. FERNALD (*New York and London: McGraw-Hill Book Co., Inc., 1921, pp. XIV+386, figs. 388*).—This work, based upon many years of experience by the author at the Massachusetts College and Station, is offered as a classroom textbook for an introductory course in the subject which will give a general idea of insects, their structure, life histories, and habits, with methods for the control of insect pests in general, followed by a more thorough study of the more important ones occurring in the United States. The 10 chapters forming the first part of the work, which are followed by 23 others devoted to the various orders, are respectively as follows: Insects and other animals; the insect, its external structure; the insect, its internal structure; the development of insects; losses caused by insects, nature's control methods; artificial methods of control; insecticides in general, stomach poisons; contact insecticides; insecticides and fungicides, fumigation; and the relationships of insects.

Protecting the United States from plant pests, C. L. MARLATT (*Natl. Geogr. Mag., 40 (1921), No. 2, pp. 205-218, figs. 16*).—This article by the chairman of the Federal Horticultural Board, U. S. Department of Agriculture, deals with the inspection work being conducted under the plant pest law with the view to preventing the introduction of foreign plant pests, particularly insects.

Agricultural insecticides, R. R. HENDERSON (*Chem. Age [New York], 29 (1921), Nos. 5, pp. 167-169; 6, pp. 205-207, figs. 3; 7, pp. 257-260, figs. 4; 9, pp. 353-355, fig. 1*).—Three papers are presented dealing, respectively, with the

uses, economic importance, and growth of manufacture of agricultural insecticides; with raw materials and methods of manufacture; and with the distribution, present status of the industry, and problems to be solved.

[Report of the] division of entomology, C. P. LOUNSBURY (*Union So. Africa Dept. Agr. Rpt. 1918-19, pp. 97-109*).—This is a detailed report of work carried on during the year by the entomological division, including accounts of the occurrence of some of the more important insect enemies of the year.

The insect enemies of tobacco in the Dutch East Indies, H. JENSEN (*Proefsta. Vorstenland. Tabak [Dutch East Indies], Meded. 40 (1921), pp. 59-143, pls. 33, figs. 25*).—This is a summary of information on the insects attacking tobacco in the East Indies, with references to the more important literature relating to many of them.

Methods of combating four field crop pests in Colorado, C. R. JONES, J. HOERNER, and C. L. CORKINS (*Colo. Agr. Col. Ext. Bul., 1. ser., No. 179 A (1921), pp. 28, figs. 23*).—Brief accounts are given of the beet webworm (*Loxostege sticticalis* L.), the alfalfa webworm (*L. commixtalis* Wlk.), the army cutworm (*Chorizagrotis auxiliaris* Grt.), and the pale western cutworm (*Porosagrotis orthogonia* Morr.), with control measures.

Common garden insects and their control, A. GIBSON (*Canada Dept. Agr., Ent. Branch Circ. 9 (1921), rev., pp. 20, fig. 1*).—This is a popular summary of information.

Monthly notes on grubs and other cane pests, IV, J. F. ILLINGWORTH (*Queensland Bur. Sugar Expt. Stas., Div. Ent. Bul. 15 (1921), pp. 39, figs. 4*).—These notes, in continuation of those previously noted (*E. S. R., 45, p. 55*), report work in progress from July, 1920, to June, 1921.

The rôle of crab apple trees and old cider trees in harboring certain insect pests of fruit plantations, H. W. MILES (*Jour. Pomol., 2 (1921), No. 4, pp. 274-277*).—The author calls attention to the danger of infestation of orchards and fruit plantations in Great Britain by such pests as *Anthonomus pomorum*, *Rhynchites coeruleus*, etc., from isolated trees of apple, crab, Damson, and plum growing in the open ground or in hedgerows. He recommends the removal of old trees and the application of insecticides as applied in the orchard to the younger ones.

Grasshopper control, C. L. CORKINS (*Colo. Agr. Col. Ext. Bul., 1. ser., No. 180 A (1921), pp. 16, figs. 7*).—Methods of control are given for the two-striped locust (*Melanoplus bivittatus* Say), the lesser migratory locust (*M. atlantis* Ril.), the red-legged locust, and the differential locust (*M. differentialis* Uhl.).

Grasshoppers of Tennessee, S. MARCOVITCH (*Tenn. State Bd. Ent. Bul. 33 (1920), pp. 112, figs. 49*).—This work includes keys for the identification and descriptions of the more important species of Orthoptera occurring in Tennessee.

The cockroach: Its life history and how to deal with it, F. LAING (*Brit. Mus. (Nat. Hist.), Econ. Ser., No. 12 (1921), pp. 18, figs. 3*).—This is a popular summary of information.

The potato leafhopper and its control, J. E. DUDLEY, JR. (*U. S. Dept. Agr., Farmers' Bul. 1225 (1921), pp. 16, figs. 14*).—This is a popular summary of information on *Empoasca mali* Le B., its importance as an enemy of the potato, and means for its control. The account is based upon investigations conducted by the author, reports of which have been previously noted (*E. S. R., 44, p. 549; 45, p. 552*). The use of Bordeaux mixture, 4:4:50, has been found to be the best means of control.

Carrot leaf curl, caused by *Triozia viridula*, S. ROSTRUP (*Tidsskr. Planteavl, 27 (1921), No. 4, pp. 617-630, figs. 4*).—Carrot leaf curl, caused by *T. viridula*,

a psyllid, has been the source of great loss throughout Denmark for a number of years. From 1900 to 1910 it was largely confined to Sealand, where, particularly in the northern section, it did so much injury that carrot growing was practically rendered impossible. Recently it has spread further and has done much damage in many parts of Jutland, particularly in 1920. Spraying with a solution of tobacco extract against both the immature and adult stages has been found effective.

Report of the froghopper blight of sugar cane in Trinidad, C. B. WILLIAMS (*Trinidad and Tobago Dept. Agr. Mem. 1 (1921), pp. X+11-170, pls. 11, figs. 32; abs. in Rev. Appl. Ent., 9 (1921), Ser. A, No. 5, pp. 261-263*).—This report deals with the nature of the blight (pp. 20-29); the history of the blight in Trinidad (pp. 30-42); froghoppers in other countries, and legislation against further spread (pp. 43-52); the Trinidad froghopper, *Tomaspis saccharina* (pp. 53-64); the natural enemies of the froghopper (pp. 65-93); the root disease of sugar cane (pp. 93-95); the factors influencing the prevalence of blight (pp. 96-121); theories of damage and general problems (pp. 122-131); methods of control (pp. 132-149); a summary (pp. 150-162); and a bibliography (pp. 163-170).

The grass-feeding froghopper or spittle bug (*Philaenus lineatus* L.), P. GARMAN (*Connecticut State Sta. Bul. 230 (1921), pp. 325-334, pls. 2, figs. 3*).—In this report the author supplies some of the links missing in the knowledge of this insect. In localities favorable to its development this insect may become abundant and cause considerable damage to meadow grasses. In Connecticut, orchard grass, timothy, red top, and blue grass are infested by it.

Its life cycle lasts a year, the greater part of which is passed in the egg stage, the eggs being deposited throughout the summer and fall. They are placed between the leaf and the main stem, there usually being four or five together, within 2 or 3 in. of the ground. Records presented show the incubation period to vary from 228 days for eggs deposited September 9 and 12, 1920, to 281 days for eggs laid July 19. But few eggs are laid by an individual, not over 12 having been obtained in breeding cages from a single female. The nymph passes through four instars in an average of about 28 days and lives about 1.5 months. In 1921 nymphs were present in field cages from April 20 to June 14. The adults were observed from June 14 until frost and oviposited from July to October. The preoviposition period is said to be about one month.

The spittle from the glands, the openings of which are on the seventh and eighth segments, is expanded with air and serves to protect the nymph from predacious and parasitic enemies and partly from adverse climatic conditions.

Technical descriptions are given of its several stages, the length of which is graphically illustrated by means of a diagram. Control measures consist in burning over the land in the fall, winter, or early spring.

Apple aphids, M. H. RUHMAN (*Brit. Columbia Dept. Agr., Hort. Branch Circ. 39 (1921), 2. ed., pp. 7, figs. 4*).—A brief popular account of plant lice attacking the apple in British Columbia, namely, the European grain aphid, the rosy aphid, the green apple aphid, and the woolly aphid, and means for their control.

The experimental production of winged forms in an aphid, *Myzus ribis* L., M. D. HAVILAND (*Ann. Appl. Biol., 8 (1921), No. 2, pp. 101-104*).—This is a report of observations of the red currant aphid.

The practical significance of the revolution of the embryo in aphid eggs, A. C. BAKER (*Science, n. ser., 54 (1921), No. 1389, pp. 133-135*).—The important bearing that certain phases of the embryonic development have on the hatching

of the egg under varying conditions is pointed out. The eggs are much more susceptible to contact and similar injury after the revolution of the embryo.

A descriptive catalogue of the scale insects ("Coccidae") of Australia, II. W. W. FROGGATT (*N. S. Wales Dept. Agr., Sci. Bul. 18 (1921), pp. 159, figs. 111*).—This second part of the catalogue previously noted (*E. S. R.*, 42, p. 453) describes 197 species, belonging to 33 genera, of which 37 species are new to science. The subfamilies Lecaniinae, Dactyloptiinae, and Brachyscelinae are dealt with.

The larger corn stalk borer in Virginia. W. J. PHILLIPS, G. W. UNDERHILL, and F. W. POOS (*Virginia Sta. Tech. Bul. 22 (1921), pp. 3-30, figs. 17*).—This is a report of work with *Diatraea zeacolella* Dyar, conducted by the Bureau of Entomology, U. S. Department of Agriculture, in cooperation with the Virginia State Crop Pest Commission, which was commenced in the fall of 1916 and continued each year for a period of four years.

The infestation of this pest appears to be quite general, and often severe, in the eastern and southern parts of Virginia. In the tidewater section the moths apparently begin to emerge about May 20 to 25, the eggs are usually deposited within 48 hours after emergence, and the larvae hatch out in from 10 to 15 days. Twenty larvae of the first generation were found to require from 22 to 50, with an average of 31.45, days to complete their growth, having molted from 4 to 7 times. The pupal stage varied from 9 to 14, with an average of 11.31 days, a few pupae having been observed as early as the first week in July. Under cage conditions at Charlottesville adult moths began to emerge August 8. Twenty-two larvae of the second generation observed were found to molt from 5 to 6 times within a period of from 46 to 83, or an average of 58.63, days.

Weighing tests show the total loss per acre to be higher in early than in relatively late corn. The percentage of plants infested by the first brood is practically always negligible in late corn, while the infestation by the second brood is invariably high. Corn planted about May 20 or thereafter is comparatively free from infestation by the first brood. Weighings in two localities show that a 55 to 60 per cent infestation by the second brood may damage the corn yield but slightly. A classification of the ears harvested in 1920 show that uninfested stalks yield as high as 20 per cent more first grade ears than the infested, and also that the percentage of barren stalks is noticeably higher for the infested than for the uninfested stalks.

About 30 specimens of *Miotropis clisiocampae* Ash. were reared from a single pupa from Suffolk, Va., in March, 1918. It is pointed out that rotation of crops is not an effective remedy, and that the same is true of fall plowing of corn land. The investigations have shown that the pest can be controlled easily and economically by plowing out the corn stubble with a turning plow by December 10, harrowing it over immediately, and allowing the stubble to remain undisturbed until the first week of March. While no definite data on the cost of the operation on a large scale was obtained, the authors' experiences indicate that an average man and team could easily apply this measure to 8 acres of corn stubble in 10 hours where the corn has been cut and no plowing is done between the rows. In the authors' opinion one thorough treatment in a large community should be sufficient for several years. Observations made in April of 1917 at Tappahannock, Va., showed 100 per cent mortality in the plowed stubble as against 57.9 per cent on the unplowed stubble. Observations made the following year at Suffolk and Richmond, at which points stubble was plowed out in November and examinations were made in March,

showed a mortality of 96 and 100 per cent, respectively, in the plowed stubble as against 48 and 75 per cent in the unplowed stubble. In experiments in the winter of 1919-20 there was an average mortality of 99.4 per cent in the plowed stubble as against 35.9 per cent in the unplowed stubble. The observations led to the conclusion that the mortality of the larvae varies directly with the severity of the winters, but in an average winter there should be almost 100 per cent control.

Reference is made to the report of investigations of the species by Leiby in North Carolina (E. S. R., 45, p. 58), the account by Ainslie (E. S. R., 40, p. 856), and others.

The peach borer: How to prevent or lessen its ravages; the paradichlorobenzene treatment, A. L. QUAINANCE (*U. S. Dept. Agr., Farmers' Bul. 1246 (1921), pp. 14, figs. 12*).—An account is given of the peach tree borer and means for its control by the paradichlorobenzene method on trees six years of age or older. The bulletin is based upon work by Blakeslee commenced in 1915 and reported upon in 1919 (E. S. R., 42, p. 54). The investigations have shown that, when properly used, this chemical is uniformly effective in killing a high percentage of the borers without injurious results to trees six years of age and older, and have resulted in the adoption of the treatment by many commercial peach growers.

Fighting peach tree borers with gas, A. F. MASON (*Penn. Farmer, 50 (1921), No. 10, pp. 3, 16, fig. 1*).—The author, at the New Jersey Experiment Stations, calls attention to the work of Blakeslee (E. S. R., p. 54) and of Peterson (E. S. R., 45, p. 758), who have found that excellent results can be obtained from the use of paradichlorobenzene gas against the peach tree borer.

It is stated that during the summer of 1920 the extension department conducted 36 demonstrations for borer control with paradichlorobenzene with all types of soil, ranging from the lightest sands to the heaviest red clay, and including nearly 4,000 trees.

The dates of application ranged all the way from August 3 to September 23, but were before September 15 in 25 experiments conducted in various parts of the State. In each orchard three blocks of trees were used, and the total number of borers found in the untreated blocks was 1,276, in the blocks treated with 1 oz. 302, and with 0.5 oz. 201.

In similar experiments conducted in 10 other orchards the material was applied after September 15. In these the check plats had a total of 743 borers, the trees treated with 0.5 oz. 33, and the trees treated with 1 oz. only 19. That the trees treated before September 15 did not turn out so well was due to the fact that many borers hatched out after the material had been applied and did not go down into the ground but stayed high up on the trunk, thus escaping the fumes. While the station is only recommending its use on trees six years or older, many growers in New Jersey are said to have used paradichlorobenzene on trees as young as two years without enough injury to prevent them from applying it the following year.

Paradichlorobenzene (p-c-benzene) for controlling the peach tree borer, A. PETERSON (*New Jersey Stas. Circ. 126 (1921), pp. 3-11, figs. 6*).—This is a popular summary of information on the use of paradichlorobenzene in the control of the peach tree borer. A table giving the results of short time treatments of paradichlorobenzene on 10 or more varieties of peach trees in several orchards throughout New Jersey during the fall of 1920 and the spring of 1921 is appended.

The fruit-tree leaf-roller, J. R. PARKER (*Mont. State Hort. Soc. Rpt. Proc., 24 (1921), pp. 18-23*).—This is a summary of information on *Archips argyrospila* Wlk., and means for its control in Montana.

The author recommends that the trees be thoroughly sprayed while dormant with miscible oil at the rate of 8 gal. to 100 gal. of water. The trees should be carefully observed when the leaf buds are breaking, and if young worms are hatching in numbers arsenate of lead should be applied at the rate of 6 lbs. of paste in 100 gal. of water. If the worms still persist, the application of lead arsenate should be made when the blossom buds have separated in the clusters.

Reference is also made to the experience of Thompson (E. S. R., 45, p. 855).

Results of codling moth control campaign in 1920, J. C. WOOD (*Mont. State Hort. Soc. Rpt. Proc.*, 24 (1921), pp. 11, 12).—This is a review of control work carried on during the year.

A destructive bud worm of apple trees (*Haploa lecontei*), H. GARMAN (*Kentucky Sta. Circ.* 25 (1921), pp. 3-11, figs. 5).—The larvae of this bud worm were first received from Ohio County, Ky., in 1920, where they were devouring the buds of apple trees and were most abundant on young trees. At the station the larvae were found to feed upon and devour a large number of buds of several different plants, including the native crab apple, Japanese quince, pear, peach, and wild cherry. As the buds unfolded the larvae were found to eat the young leaves also. They continued to develop until April 8, when they commenced to spin loose webs on the bottom of the jars in which they were kept, preparatory to pupation. Several days were passed in their webs before pupation, the first to pupate having been observed on April 16, and by the last of the month all had changed. The first adults emerged about May 14, and others emerged on May 19 and 22.

This insect is thought to be the same as that described by C. V. Riley in 1871 as the blue-spangled peach worm (*Callimorpha fulvicosta*). It was reported by S. A. Forbes in 1889 as destructive to raspberry in southern Illinois by creeping up the stems and devouring the buds. A technical description of its several stages is included.

New species of Lepidoptera in the United States National Museum, W. SCHAUS (*U. S. Natl. Mus. Proc.*, 57 (1921), pp. 107-152; 59 (1921), pp. 349-396).

Mosquito survey of Mayaguez, W. V. TOWER (*Porto Rico Sta. Circ.* 20 (1921), pp. 10, pls. 4).—In the course of a mosquito survey made by the author in and around Mayaguez, eight species of mosquitoes were collected, of which three are very common, namely, the common house mosquito of the Tropics (*Culex quinquefasciatus*), the yellow-fever mosquito (*Aedes (Stegomyia) aegypti*), and the malarial mosquito of Porto Rico (*Anopheles albimanus*). A second species of *Anopheles*, *A. grabhamii*, has also been found on the island. The places in which mosquitoes were found breeding are briefly described, and instructions are given as to how to free and keep the community free from mosquitoes.

Top minnows in relation to malaria control, with notes on their habits and distribution, S. F. HILDERBRAND (*Pub. Health Serv. U. S., Pub. Health Bul.* 114 (1921), pp. 34, pls. 12, figs. 8).—Studies here reported show *Gambusia affinis* to be by far the most important natural enemy of the mosquito known to date. It is abundant in nearly all permanent standing bodies of water and sluggish streams accessible to it throughout the malarious sections of the South. *Mollesia latipinna* is found to subsist on plants and has no value as a mosquito eradicator. *Heterandria formosa* occurs in fresh-water swamps and ditches of the coastal plains from North Carolina to Florida, produces new broods of young at short intervals, and lives among vegetation. A limited range of experiments and observations indicates that it is a serious enemy of the immature mosquito.

Preliminary observations on the habits of *Oscinella frit* L., N. CUNLIFFE (*Ann. Appl. Biol.*, 8 (1921), No. 2, pp. 105-134, figs. 3).—The observations here reported have been summarized by the author as follows:

"The adult frit fly is prevalent in the field throughout the year except for the period November to April. There are periods of high prevalence, which are probably limited by meteorological conditions. High prevalence seems to be associated with high temperatures and emergence with rainfall, and should not be associated with any particular brood or generation.

"It is very probable that normally four generations are produced in one year and that the fly is double brooded. The periods between the emergence of successive generations are about 50 days in spring, 35 days in summer, and 230 to 250 days in winter. *Arrhenatherum avenaceum*, *Festuca pratensis*, *Lolium italicum*, *L. perenne*, and *Poa annua* can be utilized as host plants in the summer and *Alopecurus myosuroides*, *A. avenaceum*, *Hordeum pratense*, *L. italicum*, and *L. perenne* in the winter. In captivity the longevity of the imago averages 50 days in spring and summer.

"Ploughing in and rolling would only control the pest on heavy land. Nitrogenous manures are not likely to repay the cost of application on average land in England. The following hymenopterous parasites are recorded, for the first time, as attacking frit fly: *Chasmodon apterus* Nees, *Psichaera* (Först.) spp., *Aphidius granarius*, and *Dicyclus fuscicornis* Wlk."

Results of work on blister beetles in Kansas, F. B. MILLIKEN (*U. S. Dept. Agr. Bul.* 967 (1921), pp. 26, figs. 22).—The account here presented is based upon observations at Garden City, Kans., from March, 1913, to May, 1915, and at Wichita, Kans., from June, 1915, to June, 1917.

In the drier portions of western Kansas and adjoining States the insect fauna is particularly rich in blister beetles, which feed on native legumes and other plants that root deeply and make some growth even when cultivated crops and shallow rooted weeds die of drought. Attention is called to the fact that while in the early days, before the species of grasshopper responsible for a large share of injury to agriculture (*Melanoplus spretus* Uhl.) had disappeared from the plains region, there was a tendency to class the western species of blister beetles as beneficial, due to the fact that their larvae feed on the eggs of grasshoppers. Its economic status to-day is different, for with the presence of beans, peanuts, alfalfa and sugar beets the blister beetle has become an important pest. It is pointed out that where blister-beetle larvae infest a large percentage of grasshopper egg capsules, they must destroy many larvae of the bee fly *Anastoechus nitidulus* Fab., and of the hymenopterous egg parasite *Scelio monticola* Brues, which destroy many more grasshopper eggs than do the blister-beetle larvae. While on beans, peanuts, and locust trees, and largely on alfalfa, the blister beetles may devour only the petals and pollen of the flowers, on Irish potatoes, sugar beets, and to a lesser extent on the Russian olive, they commonly defoliate the plant, the actual injury depending on the stage of growth which the plants have reached.

Brief notes on observations of *Meloe* sp. and *Cantharis reticulata* Say are followed by a key to the species of *Epicauta* and *Macrobasis* collected at Garden City. Technical descriptions are given of the several stages of *Macrobasis immaculata* Say and of *M. unicolor* Kirby, followed by notes on observations of their life history and habits, particularly of the former species. Similar descriptions and accounts of observations are given of *Epicauta maculata* Say, *E. cinerea* Forst., *E. sericans* Lec., and *E. pennsylvanica* De G. Marked variations in the time required for the development of these beetles observed during the course of the investigations are discussed at some length.

Tests made of control measures show that the smaller beetles are easily held in check by the application of 1 lb. of Paris green with lime to every 25 to 40 gal. of water. Many of the larger species are killed by the stronger solution. Dusting with 1 lb. of Paris green to 5 lbs. of powdered lime or with pure lead arsenate is effective against the smaller beetles, but can not be recommended against the larger ones. The habit of the blister beetles when disturbed to drop or climb down rapidly to the ground and run away, led to the discovery that this habit may be made use of whenever the work of the beetles must be checked at once. At Garden City five persons formed in a line and advanced through the fields, knocking the beetles from the plants with brooms, sticks, or pieces of brush, thus clearing 25 acres of beets in half a day.

The "mealy" or "grayback" cane beetle, E. JARVIS (*Queensland Agr. Jour.*, 16 (1921), No. 1, pp. 46-50, figs. 16).—This is a summarized account of the life history of *Lepidoderma (Lepidiota) albohirtum* Waterh., with descriptions of its several stages.

The coffee berry borer on the east coast of Sumatra, J. B. CORPORAAL (*Meded. Alg. Proefsta. Alg. Ver. Rubberplanters Oostkust Sumatra, Alg. Ser.*, No. 12 (1921), pp. 20, pl. 1, fig. 1).—*Stephanoderes hampei* Ferr., probably introduced into Sumatra with seed coffee from Java, infests most of the estates on the east coast of Sumatra. In Siantar the percentage of attacked berries varied from 5 to 99 per cent.

Its development in the egg stage varies from 5 to 6 days, in the larval stage from 10 to 21 days with an average of 14, including a rest of 2 days before pupating, and in the pupal stage from 4 to 6 and occasionally 8 with an average of 5 days. Thus the life cycle requires from 20 to 35 days, with an average of 25 days. The larvae feed principally upon the tissues of the bean, though they may also feed on borings or saprophytic fungi. The pest seldom occurs in young berries, a certain degree of ripeness being necessary. It can breed quite well in prepared market coffee, especially if it is not too dry.

Control measures are outlined.

The control of bark-beetle outbreaks in British Columbia, R. HOPPING (*Canada Dept. Agr., Ent. Branch Circ. 15* (1921), pp. 15, figs. 13).—A brief account is given of the more important bark beetles occurring in British Columbia and means for their control. It is pointed out that a thorough campaign of slash disposal and control of incipient outbreaks would stop the tremendous loss from this cause in the past to the forests of the Province and also much of the fire loss now caused by slash and dead standing timber.

A cooperative campaign to save the horse bean crop, E. R. DE ONG and H. E. WOODWORTH (*Calif. Dept. Agr. Mo. Bul.*, 10 (1921), No. 5-6, pp. 199-203, figs. 3).—This relates to control measures for *Bruchus rufimanus*.

Three new myrmecophilous beetles, W. M. MANN (*U. S. Natl. Mus. Proc.*, 59 (1921), pp. 547-552, figs. 6).

The strawberry-rot weevil (*Otiorhynchus ovatus* L.), R. C. TREHERNE, rev. by W. DOWNES (*Brit. Columbia Dept. Agr., Hort. Branch Circ. 33* (1921), 3. ed., rev., pp. 4, figs. 2).—A popular account of this pest and means for its control in the Province of British Columbia, where it is one of the most important insect enemies of the strawberry.

The honey situation, E. H. TUCKER (*Better Fruit*, 16 (1921), No. 1, pp. 8, 9, fig. 1).—This paper contains statistical data upon honey production, particularly such as relate to the State of California.

Beekeeping for New Hampshire, W. H. WOLFF (*N. H. Agr. Col. Ext. Bul. 15* (1921), pp. 16, figs. 5).—This is a summary of information on beekeeping as applied to New Hampshire conditions.

Beekeeping in the South, K. HAWKINS (*Hamilton, Ill.: Amer. Bee Jour.*, 1920, pp. 121, pl. 1, figs. 57).—This is a small handbook on seasons, methods, and honey flora of the 15 Southern States.

The cotton plant as a source of nectar, H. B. PARKS (*Amer. Bee Jour.*, 61 (1921), No. 10, pp. 391–393, figs. 5).—It is pointed out that in the southeastern part of the United States cotton is looked upon as being a poor honey plant, while in Texas, parts of Oklahoma, Arkansas, and the Imperial Valley of California it is one of the best producers.

Control of the Argentine ant in California citrus orchards, R. S. WOGLUM and A. D. BORDEN (*U. S. Dept. Agr. Bul.* 965 (1921), pp. 43, figs. 21).—This is a report of investigations of methods of control and eradication of *Iridomyrmex humilis* Mayr commenced in 1915 and continued until 1920, a preliminary account of which has been noted (*E. S. R.*, 41, p. 166). The methods made use of in the course of the work included banding trunks to prevent access of the ant, trap nesting, repellents, and poison sirup.

Of the substances tried in banding, a mixture composed of one part sulphur to six parts of commercial sticky tree-banding material proved most satisfactory. The careful attention necessary to keep the bands in a freshened condition, their high cost, etc., led to its discontinuance. Trap nesting was found to be impractical under southern California conditions because of the light average rainfall and the excessive cost as compared to that of the use of a poisoned sirup. Repellents in the form of corrosive-sublimate bands and powders prepared from pyrethrum and sodium fluorid were found to have a limited use about residences, apiaries, etc.

"The most practical means of control was the complete eradication obtained by the use of an arsenical poisoned sirup. Numerous formulas were prepared and tried in large field experiments. Of these the original Barber formula proved effective but was objectionable because of rapid crystallization. Various modified formulas were used and one finally adopted which contained all the ingredients of the Barber formula, somewhat reapportioned, and, in addition, the preservative benzoate of soda. The modified formula gives a much thinner sirup, one of greater stability, and also a considerably cheaper one. The arsenical poisoned sirups have been used in various parts of southern California on almost 3,000 acres of citrus with excellent results. Ants have been totally eradicated from many hundreds of acres with one or two applications. It is essential that the sirup be carefully and properly prepared.

"In orchard distribution approximately 1.5 oz. of sirup is placed in a 4-oz. spice tin with a few strands of excelsior, and such a tin is hung on the trunk or a main branch of each infested tree. Spring and autumn are the preferred periods for this work. Monthly inspection should be made and empty and removed containers refilled and replaced. The average cost per tree has been between 4 and 5 cents. This method has proved equally successful in eradicating the ants about residences. Much care should be given to bait each trail, at intervals of 10 to 15 ft., with either a spice tin or a ground trap.

"The eradication of the Argentine ant has resulted in commercial control of mealybugs and the soft brown scale over a large area in the citrus districts of southern California."

Earlier accounts of this pest have been noted (*E. S. R.*, 43, p. 259).

Some notes on wasps of the subfamily Nyssoninae, with descriptions of new species, S. A. ROHWER (*U. S. Natl. Mus. Proc.*, 59 (1921), pp. 403–413).

Suggestions for the control of red spiders in deciduous orchards, E. R. DE ONG (*Calif. Dept. Agr. Mo. Bul.*, 10 (1921), No. 5–6, pp. 186–191, figs. 2).—The habits and appearance of the three spider mites *Tetranychus telarius* L.,

T. citri McG., and *Bryobia pratensis* Gar. and means for their prevention and control are discussed.

The life and behavior of the house spider, H. E. EWING (*Iowa Acad. Sci. Proc.*, 25 (1918), pp. 177-204, figs. 12).—This is a report of observations of the life history and bionomics of the common house spider (*Theridion tepidariorum* K.).

New Nearctic spider mites of the family Tetranychidae, H. E. EWING (*U. S. Natl. Mus. Proc.*, 59 (1921), pp. 659-666, pl. 1).

FOODS—HUMAN NUTRITION.

Analyses and energy values of foods, R. H. A. PLIMMER (*London: Govt.*, 1921, pp. 255).—The analyses reported in this volume were made for the use of the British Army medical authorities and include proximate analyses and calculated energy values of a large number of animal and vegetable foodstuffs such as are sold and consumed in Great Britain. As stated in the introduction, "the aim has been to arrive at an average for each group of foodstuffs, such as beef from analyses of the various joints, bread from the produce of various bakeries, fish from the group of white fish, etc. In the cases of meat, fish, etc., the joints were separated into fat and skin and lean, flesh and skin, etc., and the proportions determined so as to calculate the whole. Further, the proportions of the joints of the carcass have been ascertained so that the composition of any part and ultimately of the whole animal can be arrived at. The analyses are thus not a replica of those of Atwater and Bryant, but may rather be regarded as a supplement."

Complete analyses are first presented of meat products, eggs, milk and dairy products, poultry and game, fish, fresh and dried vegetables, cereals, flour, etc., fresh and dried fruits, jams and honey, nuts, cocoa, chocolate, and sugar. The detailed analyses are followed by an alphabetical summary of the analyses for army use and an appendix containing tables of distribution of vitamins, rearranged from the report of the Medical Research Committee (*E. S. R.*, 43, p. 262).

Supplementary protein values in foods.—I, The nutritive properties of animal tissues. II, Supplementary dietary relations between animal tissues and cereal and legume seeds. III, The supplementary dietary relations between the proteins of the cereal grains and the potato. IV, The supplementary relations of cereal grain with cereal grain, legume seed with legume seed, and cereal grain with legume seed, with respect to improvement in the quality of their proteins. V, Supplementary relations of the proteins of milk for those of legume seeds, E. V. MCCOLLUM, N. SIMMONDS, and H. T. PARSONS (*Jour. Biol. Chem.*, 47 (1921), No. 1, pp. 111-247, figs. 54).—In this series of papers dealing with the dietary properties of several types of food mixtures, the interpretation of results is based not only upon the rate and extent of growth of the rats used as experimental animals, but also upon fertility, success in the rearing of young, and general condition of the animals up to and including the onset of old age. With the material serving as the sole source of protein at a level of 9 per cent of the diet and with the other dietary factors satisfactorily constituted, the relative biological values of the proteins of the various animal and vegetable substances studied have been arranged in descending order from left to right as follows:

beef kidney—wheat—	{	milk liver (beef)	{	muscle	{	maize oats	{	soy beans
				(round steak)				navy beans
				barley				peas
				rye				

In making deductions from these results it is emphasized that while animal tissues such as liver, kidney, and muscle appear to be superior to milk for the specific purpose of making good the deficiencies of the proteins of the seeds and tubers, milk is an effective supplement for these vegetable foods with respect to other factors as well as protein, particularly calcium and vitamin A. It is also emphasized that muscle tissues supplement seeds, tubers, etc., only with respect to the protein, and that other deficiencies of even greater importance are always found in the storage tissues of plants—seeds, tubers, and roots.

Researches in regard to wheat, flour, and bread, C. E. SAUNDERS, R. W. NICHOLS, and P. R. COWAN (*Canada Expt. Farms Bul. 97* (1921), pp. 57, figs. 7).—This publication reports the results of an extensive investigation of factors involved in bread making, including the influence of different varieties of wheat and different kinds of flour, methods of milling and of baking, and the effect of various ingredients used in bread making on the finished loaf. Earlier studies along these lines from the same laboratory have been reported previously (E. S. R., 19, p. 861).

To give numerical expression to baking strength, which is defined as "the ability of the flour to take up and contain water and to produce a large loaf of very fine texture and with a dome-shaped upper crust," an empirical method was adopted using weighted values for water absorbed, water retained, volume of loaf, shape of loaf, crust formed, and texture. It is emphasized that different figures for the baking strength of flour can be obtained by the use of different methods of examination, and that for such tests to be of any value a standardized procedure should be consistently followed. Such a procedure is described in detail and has been used in the work reported, some of the results of which may be summarized as follows:

The greater the amount of yeast used the shorter the length of the fermenting period, and up to a certain amount the larger the volume and the better the form and texture of the loaf. Initial mixing of the dough and the second kneading should be thorough, but excessive kneading and mixing adds nothing to the quality of the product and may be detrimental. Within certain limits, depending upon the temperature and the amount of yeast employed, the longer the fermentation, the larger the loaf, the better the texture and color, and the poorer the flavor. The characteristic taste of homemade bread is attributed to the shorter period of fermentation usually employed.

About 1.4 per cent of salt is considered to be the best proportion to use and from 2 to 3 per cent of fat. Of the various fats tested peanut oil was found to be the most desirable from the standpoint of baking strength of the bread. Next in order were lard and cottonseed oil, followed by butter. Coconut oil proved undesirable. The addition of a small amount (0.8 per cent) of malt without sugar or about half this amount with the usual amount of sugar increased the volume of the loaf, improved it in shape, texture, and color, and shortened slightly the period of fermentation. An excess of malt produced a sticky bread of poor quality. The addition of from 1.2 to 2.4 per cent of sugar produced about the same effect as did the smaller amount of malt. Scalded milk and milk powder tended to decrease the volume of the loaf.

Tests with a few so-called "bread improvers," including alum, ammonium chlorid, calcium sulphate, citric acid, calcium phosphate, cream of tartar, and baking soda, indicated that slight improvement in the quality of the bread results in the use of some but not all of these compounds. "A great deal of further research is required in regard to bread improvers with a view to a better understanding of their action and the limitations which should be put on their use."

A single series of tests of flour obtained from wheat grown for five successive years on plats to which the same amount of different fertilizing materials had been added and from the same variety of wheat on unfertilized plats showed no material variations in baking strength which could be attributed to the fertilization of the soil on which the wheat was grown. Further investigation of this point is considered advisable.

The study of the baking strength of different varieties of wheat led to the following conclusions, many of which contradict the ordinary beliefs: While on the average spring wheats give stronger flour than winter varieties, this is not always the case, nor is it invariably true that the harder flour will always give the best baking strength. The color of the bran has nothing to do with baking strength. The baking strength of any variety is not a fixed character nor is it inherited as a Mendelian unit character. Wheat which has been thoroughly ripened has gluten of a higher quality than wheat matured under cool conditions. A mixture of flours from two different kinds of wheat has not been found to yield a better loaf than either variety alone, but intermediate between the two.

Storage of new wheat or new flour for a few months gives an increase in water-absorbing power and a natural bleaching of the flour. The artificial bleaching of flour, contrary to popular impression, does not have the same favorable effect on the flour. Wheat which has been subjected to rain or dampness, if it is not distinctly musty or sprouted, may have as good baking qualities as dry wheat. Wheat which has been frozen should be looked on with suspicion.

In discussing the relative merits of commercial flours, the authors conclude that the flour percentage extracted for human use should lie between 80 and 85 per cent; that palatable bread, biscuits, or cakes can not be made from pure gluten flour; that a second patent or cheaper grade of flour will make a lighter loaf than first patent; and that in making breads with partial substitution of other materials than wheat the substitute material should not exceed 25 per cent.

In conclusion a few suggestions and directions for home bread making are given, with tables of weight in grams and ounces of salt, sugar, and lard as usually measured by the spoonful or cupful.

Studies on the digestibility of proteins in vitro.—II, **The relative digestibility of various preparations of the proteins from the Chinese and Georgia velvet beans**, H. C. WATERMAN and D. B. JONES (*Jour. Biol. Chem.*, 47 (1921), No. 2, pp. 285-295).—The method of Waterman and Johns employed in the previous paper (*E. S. R.*, 45, p. 763) has been applied to the estimation of the comparative digestibility in vitro of six preparations of the proteins of the Chinese and Georgia velvet beans.

The data obtained show that, as in the case of soy bean, partial indigestibility is the limiting factor in the failure of raw dialyzed velvet bean protein to promote growth, and that the normal growth secured with the coagulated protein is probably to be attributed to an increase in digestibility brought about by the boiling incident to the preparation of the coagulated protein. The double disadvantage of toxicity and nonassimilable protein content is thought to explain the ill effects sometimes following the use of velvet-bean meal in stock feeds, while the cooked meal probably still contains the toxic substance dihydroxy-phenylalanin isolated by Miller (*E. S. R.*, 44, p. 710).

Some factors affecting the quality of ripe olives sterilized at high temperatures, W. V. CRUESS (*California Sta. Bul.* 333 (1921), pp. 221-231, figs. 2; also in *Fig and Olive Jour.*, 6 (1921), No. 5, pp. 2, 3, 5).—This bulletin reports an investigation, extending over two canning seasons, of the conditions which

must be observed to obtain acceptable products when ripe olives are subjected to sterilization at 240° F. for 40 minutes, as required by the California State Board of Health.

The observations reported confirm in most cases preliminary observations previously noted (E. S. R., 44, p. 762). The Manzanillo was found to be more sensitive to high temperatures than the other varieties, but by using slightly unripe rather than perfectly ripe fruit an acceptable product can be obtained. The Sevillano variety was in some cases improved in flavor by sterilization at 240°.

For holding solutions, brine of 5 per cent salt is recommended for shipment and of 10 per cent salt for holding olives in the factory for long periods. The brine should be leached from the fruit previous to pickling by soaking the fruit in water.

As previously noted, incomplete lye treatment causes the development of a bitter flavor in olives sterilized at high temperatures. Treatment with 1 per cent lye until it reaches the pit and subsequent leaching of the lye from the fruit with water gave a product with no bitter or scorched flavor. The best results in concentration of the brine for canning were obtained by placing the pickled fruit in a brine of 8 to 9 per cent concentration for from 4 to 6 days and canning the fruit in water or by gradually increasing the brine from 6 to 7 per cent after pickling, followed by canning in 2.5 to 2 per cent brine. Acidification of the brine is not recommended.

Olives retain their color more satisfactorily in lacquered than in plain cans. Olives sterilized in glass jars are apt to develop a pitted appearance when the jars are opened, probably owing to the escape of gases or steam under heavy pressure during the canning. Examination of the sterilized fruit after varying periods of storage showed that the scorched flavor noticeable in some cases at first gradually disappears, leaving a product of good flavor.

Studies in the vitamin content.—II, The yeast test as a measure of vitamin B, W. H. EDDY, H. L. HEFT, H. C. STEVENSON, and R. JOHNSON (*Jour. Biol. Chem.*, 47 (1921), No. 2, pp. 249–275, figs. 5).—Continuing previous work (E. S. R., 44, p. 260), a detailed investigation of the value of the yeast test as a measure of vitamin B is reported. The results have led the authors to conclude that “the cumulative effect of the data obtained is to suggest that in its present state the test is distinctly unreliable as a quantitative measure of vitamin content. On the other hand it suggests interesting possibilities as a method for studying the kinds and behavior of growth stimuli. . . . Until a basal medium is worked out that provides an optimum of all the factors except vitamin B, the test must be considered of little value in the estimation of true vitamin content.

An interpretation of the seasonal variation of rickets, A. F. HESS and L. J. UNGER (*Amer. Jour. Diseases Children*, 22 (1921), No. 2, pp. 186–192, figs. 2).—Six infants who had developed rickets on diets of dry “pasture milk,” malt soup, breast milk, etc., were given ultraviolet light treatment three times a week for about two months. The entire body was exposed to the rays, the length of exposure being increased from 3 to 20 minutes and the distance of the lamp from the body decreased from 120 to 75 cm.

In all cases the hemoglobin percentage and number of red cells in the blood increased, and the rickets showed definite improvement as evidenced by Roentgen ray examination. The earliest beneficial effect was noted in two cases in 26 days. This improvement occurred with no change in the diet and in the months of February and March, the season of highest rickets incidence and severity. These observations are thought to indicate that hygienic factors, especially sunlight, and not dietetic factors play the dominant rôle in the marked seasonal development of rickets.

The cure of infantile rickets by sunlight (preliminary note), A. F. HESS and L. J. UNGER (*Jour. Amer. Med. Assoc.*, 77 (1921), No. 1, p. 39).—The authors have obtained results similar to the above in the treatment of rickets by the direct action of sunlight. Infants who had contracted rickets on regular diets such as whole milk and cereal, or dried milk, cereal, and orange juice were exposed for from one-half hour to several hours to the direct action of the sun—the legs, arms, trunk, and face being in turn exposed. In all of the five cases thus treated there was a marked improvement in the rickets, as evidenced by the calcification of the epiphyses, as well as in the general condition of the infants. These observations are thought to have an important bearing on the geographic distribution of rickets and on measures for its prophylaxis and cure.

Experimental rickets in rats.—I, A diet producing rickets in white rats, and its prevention by the addition of an inorganic salt, H. C. SHERMAN and A. M. PAPPENHEIMER (*Jour. Expt. Med.*, 34 (1921), No. 2, pp. 189–198, pls. 8).—This is the detailed report of the investigation which has been previously noted from another source (*E. S. R.*, 45, p. 767). In conclusion the authors state that “while it is thus shown by X-rays and by histological examinations and by quantitative chemical analysis that added potassium phosphate increased the assimilation and normal deposition of calcium, it may be the quantitative relationship between the inorganic ions rather than actual deficiency of any one of them which was here the determining factor in the cause or prevention of rickets. Our experiments and conclusions do not exclude the possibility of other causes of rickets than those here discussed.”

A number of plates are included illustrating the rachitic changes in rib sections and epiphyses.

Experimental rickets in rats.—II, The failure of rats to develop rickets on a diet deficient in vitamin A, A. F. HESS, G. F. McCANN, and A. M. PAPPENHEIMER (*Jour. Biol. Chem.*, 47 (1921), No. 2, pp. 395–409, pls. 3, figs. 3).—The investigation noted above has been continued by a comparative study of the behavior of rats on a ration consisting of casein 21, rice starch 57, salt mixture 5, and crisco 17 per cent, with 60 mg. of yeast, and on the same ration with the substitution of 6 per cent of butter fat for an equivalent amount of crisco. One group of animals on the first diet was also given 0.5 cc. of orange juice per day.

On the diets lacking the butter fat as a source of vitamin A, the young rats invariably failed to grow and generally developed keratitis, this condition being less frequent when the ration included orange juice. On continuing this diet for a period of several months the animals died either of inanition or of some intercurrent infection. Microscopic examination of the bones of 22 rats on this ration showed definite signs of a lack of active osteogenesis, but in no instance lesions resembling rickets. The authors conclude that vitamin A can not be regarded as the antirachitic vitamin and that if the diet is otherwise adequate its deficiency does not bring about rickets.

Calcium and phosphorus in the serum in relation to rickets, J. HOWLAND and B. KRAMER (*Amer. Jour. Diseases Children*, 22 (1921), No. 2, pp. 105–119).—In an effort to explain the failure of deposition of calcium salts in the bones and in the intercellular cartilage of the epiphyses in rickets, the authors have approached the question from the standpoint of the inorganic chemical composition of the blood serum and have made a comparative study of the concentration of calcium and of inorganic phosphorus in the serum of normal adults and children and of children suffering from rickets.

A comparison of the figures for inorganic phosphorus obtained on the serum of nonrachitic children two years of age and less and on that of normal adults

showed that the figures of the two age groups are fairly uniform, but that the serum of adults regularly contains much less inorganic phosphorus than that of infants, 2.1 mg. of phosphorus per 100 cc. of serum being the average of 9 determinations in adults and 5.4 mg. of 12 determinations in children. The concentration of inorganic phosphorus in 22 rachitic children who had never been treated varied from 0.6 to 3.2 mg. per 100 cc., with an average of 2 mg. per 100 cc.

Calcium determinations on 20 normal adults gave minimum and maximum values of 9.3 and 10.6 mg. per 100 cc., with an average of 10 mg. Corresponding results in the case of 13 nonrachitic children under two years of age were 10.2, 11, and 10.7, respectively. Excluding cases of tetany, the calcium content of the serum in 12 out of 25 rachitic children fell within normal limits, while in 13 cases the concentration was lower than normal, though not significantly so.

On administering cod liver oil to the rachitic patients there was a gradual increase in the phosphorus content of the serum, commencing about two weeks after the administration of the oil and continuing until an amount was reached which was about or slightly above the average for young children. This amount was maintained indefinitely as long as cod liver oil was administered. The amount of calcium was not strikingly influenced.

These observations are considered evidence that the presence of a low inorganic phosphorus content in the serum of a young child is indicative of rickets, and that to this deficiency of phosphorus is to be ascribed the failure of calcium deposition. Attention is called to the fact that the ratio of the concentration of calcium to that of phosphorus in the serum of nonrachitic children is practically identical with the ratio of these elements in tertiary calcium phosphate, the salt which composes from 85 to 90 per cent of the salts of normal bone, and that consequently a decrease in phosphorus (HPO_4) ion would render more difficult the precipitation of tertiary calcium phosphate.

Notes on apparatus used in determining the respiratory exchange in man, I, II, C. V. BAILEY (*Jour. Biol. Chem.*, 47 (1921), No. 2, pp. 277-283, figs. 10).—Two appliances for use with respiration apparatus are described.

I. *An adaptation of the French gas mask for use in respiratory work* (pp. 277-279).—The French gas mask has been adapted as a breathing appliance to be used with the usual respiration apparatus. A satisfactory arrangement of the mask and valves for the Tissot method is described and illustrated.

II. *A sampling bottle for gas analysis* (pp. 281-283).—An appliance, designed for readily collecting and holding samples of gas and transferring them to a gas analyzing burette without danger of dilution or loss of mercury, is described and its manipulation illustrated by a series of small drawings.

Basal metabolism of normal women, K. BLUNT and M. DYE (*Jour. Biol. Chem.*, 47 (1921), No. 1, pp. 69-87).—The authors report a series of 216 determinations with the Benedict portable respiration apparatus of the basal metabolism of 17 women, 14 of them including one or more menstrual cycles. The daily variation for each subject ranged from 7.4 to 28.8 per cent, or an average of 13.2 per cent. There was, however, no definite change in the basal metabolism during menstruation, the average in calories per 24 hours being 1,351 during the intermenstrual and 1,328 during the menstrual period. Most of the subjects showed a somewhat lower basal metabolism than that calculated for them from the Benedict or Du Bois standard. There appeared to be no relation between minimum pulse rate and basal metabolism, nor was there any definite constant change in the pulse rate during menstruation.

Some observations on basal metabolism in menstruation, M. O. P. WILTSHIRE (*Lancet [London]*, 1921, II, No. 8, pp. 388, 389, fig. 1).—Observations on

the basal metabolism of five subjects during menstruation and in the intermenstrual period from the analysis of 5 minute samples of expired air and calculation of O_2 consumption per minute per square meter of body surface are reported.

The intermenstrual values varied considerably in the different subjects, although the mean value, 37.2, agreed with that given by Benedict as an average value for women. The variations during menstruation were found to be no greater than the ordinary fluctuations, thus confirming the results reported above by Blunt and Dye. Preliminary observations on the cost of work to the organism during menstruation are also reported, the results of which indicate that the cost of work and the recovery from work are the same during menstrual and intermenstrual periods. In both cases there was found to be a sharp rise in the CO_2 output and O_2 intake during exercise, followed by gradual return to the resting value when work ceased.

ANIMAL PRODUCTION.

The nutritive value of new and old maize, J. J. NITZESCU (*Pflüger's Arch. Physiol.*, 172 (1918), pp. 275-317).—Digestion and nitrogen-balance trials with 6 hens, 6 cocks, and 6 white rats are reported. Half of each group were fed newly harvested corn and the other half corn that had been stored from 1 to 4 years. The experiments with chickens lasted 40 days and were divided into 4-day collection periods. The rat experiment consisted of ten 3-day periods. The animals were in separate cages, and the data for each individual in each period are tabulated in great detail.

The starch content of the corn meal and the excreta was determined by hydrolysis with hydrochloric acid and titration against Fehling's solution. For the entire period of each experiment the average coefficients of digestibility of the new and the old corn, respectively, were as follows: Hens 92 and 96, cocks 89.6 and 95.2, and rats 92.3 and 95.4. In each of the 30 periods the coefficients for the old corn were higher than those of the new. In each experiment, although not in every collection period, more nitrogen was stored in the body by the animals fed the old corn than those fed the new. In the case of rats fed the new corn the average nitrogen balance was negative.

To distinguish between the urinary and fecal nitrogen of the fowls, the excrement was extracted with lithium hydroxid and filtered, separate nitrogen determinations being made of the filtrate and the residue. All the uric acid nitrogen passed into the filtrate as lithium urate, and the uric acid was recovered by precipitation with sulphuric acid. The ratio of uric acid nitrogen to total nitrogen of the filtrate averaged for the new and old corn, respectively, 0.608 and 0.655 in the case of the hens and 0.649 and 0.672 in the case of the cocks. Since these ratios were approximately equal to the ratio of uric acid nitrogen to urinary nitrogen in experiments with a hen and a cock operated on to permit separate collection of feces and urine, and since the uric acid excreted per day per kilogram of live weight was about the same in the fowls with normal and those with preternatural anuses, it is concluded that the nitrogen of the lithium hydroxid extract of the excreta can be considered the urinary nitrogen and the nitrogen of the residue the fecal nitrogen. On this assumption there seems to be no consistent difference between old and new corn in the digestibility of its nitrogen.

Commercial feeding stuffs as collected throughout the Dominion, F. T. SHUTT, S. N. HAMILTON, and L. V. BAKER (*Canada Expt. Farms Bul.* 47, 2. ser. (1921), pp. 70).—Proximate analyses are reported of samples of wheat bran, shorts, middlings, feed flour (red dog), barley chop, ground oats, corn meal,

corn gluten feed, rye middlings, buckwheat, linseed cake, palm kernel oil cake, cocoa shell meal, beef scrap, and a variety of mixed chop feeds, calf meals, hog feeds, and poultry feeds. Particular attention is given to the identification of the ingredients of the mixed feeds and mill products, including the identification of weed seeds and other adulterants.

Commercial feeding stuffs, A. J. PATTEN, O. B. WINTER, M. L. GRETENBERGER, and P. O'MEARA (*Michigan Sta. Bul. 292 (1921), pp. 63*).—The moisture, protein, fat, and fiber content of 529 samples of feeding stuffs collected from September, 1920, to June, 1921, are tabulated. The prices are added in most cases. The materials listed include alfalfa meal, buckwheat middlings and hulls, barley hulls, cottonseed meal, cottonseed feed, corn gluten feed, hominy feed, corn feed meal, distillers' dried grains, dried beet pulp, linseed meal, linseed cake, linseed meal and screenings oil feed, pea bran, rice bran, wheat bran with and without screenings, middlings with screenings, shorts with and without screenings, wheat mixed feed, tankage, meat scrap, and various proprietary calf meals, hog, dairy, and poultry feeds.

Influence of the plane of nutrition on the maintenance requirement of cattle, F. B. MUMFORD, A. G. HOGAN, and W. D. SALMON (*Jour. Agr. Research [U. S.], 22 (1921), No. 3, pp. 115-121*).—The authors report determinations of the net energy requirements for maintenance as computed from the feed consumption and gains of 10 head of beef cattle fed at the Missouri Experiment Station. The cattle were divided into three groups when still calves, each group representing a different plane of nutrition. The grain fed consisted of corn chop, wheat bran, and linseed meal (6:3:1). The roughage was usually alfalfa and oat straw (3:3), and a small amount of milk was given to the young calves. The determinations of maintenance requirements were made over successive periods, usually of 180 days, in the summer. The number of periods available totaled 37.

The energy gained or lost through changes in body weight were estimated from unpublished data summarized in the table below. The energy requirements for maintenance were computed by two methods: (1) from the consumption of dry matter and (2) from the consumption of digestible organic matter. The second method is that proposed by Armsby and Fries (*E. S. R.*, 36, p. 367) and is considered somewhat preferable. The digestion coefficients used were derived from digestion trials conducted at the station and the energy requirements were computed to a 1,000-lb. basis on the assumption that they are proportional to the five-eighths power of the body weight as claimed by Moulton (*E. S. R.*, 35, p. 64). The average energy requirements for maintenance of each group are given in the following table:

Net energy values of gains of steers and net energy required for body maintenance.

Group.	Rate of gain of groups.	Energy values of pound of gain at ages given.						Energy for maintenance. ¹	
		6 months.	18 months.	36 months.	54 months.	66 months.	78 months.	Dry matter method.	Armsby-Fries method.
		<i>Therms.</i>	<i>Therms.</i>	<i>Therms.</i>	<i>Therms.</i>	<i>Therms.</i>	<i>Therms.</i>	<i>Therms.</i>	<i>Therms.</i>
1	Rapid without fattening....	0.956	1.092	1.714	2.199	2.500	3.00	5.523	5.777
2	About $\frac{1}{2}$ pound per day.....	.956	1.058	1.161	1.410	1.535	1.66	4.485	4.869
3	About $\frac{1}{3}$ pound per day.....	.834	.944	1.055	1.101	1.479	1.65	3.830	4.408

¹ Daily per 1,000 lbs. live weight.

It is pointed out that the energy requirements for maintenance were in general proportional to the energy consumption. The maintenance requirements per unit weight appeared, however, not to be influenced by age.

Sunflower silage v. sorghum cane silage for beef cattle, G. R. QUESENBERRY, O. C. CUNNINGHAM, and L. FOSTER (*New Mexico Sta. Bul. 126 (1921)*, pp. 17-19).—Seven beef cows with calves at side were fed an average ration of 30 lbs. of silage, 10 lbs. of alfalfa hay, and 4.5 lbs. of grain, three of the cows receiving silage made from Russian sunflowers and others silage made from cane sorghum. The ration was not sufficient to maintain the body weights of the cows, but during two months of the experiment the cows on sunflower silage showed a greater loss per head and their calves did not grow so rapidly. However, two yearling heifers on sunflower silage gained more than two yearlings on sorghum silage.

Proximate analyses of the two kinds of silage by J. D. Hungerford are included.

Stocker cattle problems on the Cumberland Plateau, C. A. WILLSON (*Tennessee Sta. Bul. 125 (1921)*, pp. 45-62, figs. 2).—The author reports experiments with stocker cattle in the winters of 1914-15 to 1917-18 conducted on the Cumberland Plateau in cooperation with a farmer, the object being to study the feeding of silage and cottonseed meal in different proportions in comparison with the local practice of feeding dry roughage alone, mainly wild hay and corn stover. From 3 to 7 lots were fed each year, and in the last two years the experiments permitted comparisons between yearlings, 2-year-olds, and 3-year-olds.

Regardless of age, the cattle receiving silage during the winter in rations of 10 to 30 lbs. with 1 or 2 lbs. of cottonseed meal made a greater total gain for the year than cattle fed the ordinary winter ration of dry roughage. The combination of 15 lbs. of silage and 2 lbs. of cottonseed meal daily seemed to produce the maximum gains for the year. Replacement of 1 lb. of cottonseed meal by 5 lbs. of hay reduced the gains somewhat. The cattle receiving from 10 to 15 lbs. of silage and from 1.5 to 2 lbs. of cottonseed meal per day during the winter made an average gain for the year of 234.5 lbs. as yearlings, 292 lbs. as 2-year-olds, and 287 lbs. as 3-year-olds. The gains on the dry feed at the corresponding ages were 185, 236, and 217 lbs., respectively.

The steers which lost most during the winter made the biggest gains in the summer, but maximum gains for the year were attained only by steers that gained somewhat during the winter. It is pointed out that the making of silage on the Cumberland Plateau would permit the wintering of a larger number of steers and would, therefore, result in an increased utilization of the range in the summer.

Growing steers, E. L. POTTER and R. WITCOMBE (*Oregon Sta. Bul. 182 (1921)*, pp. 15, fig. 1).—This is mainly a report on three independent 2-year tests of roughages for wintering steers. The steers were purchased as calves in the fall and, except where grain was fed, were marketed after the second summer on pasture.

A full ration of alfalfa hay (average of 20 lbs. for the calves and 26 lbs. for the yearlings) was the standard with which the other feeds were compared. Straw supplemented with limited rations of either silage (10 lbs. the first winter and 15 lbs. the second) or cottonseed cake (2 lbs.) resulted in slower but still satisfactory gains. In the first experiment a lot fed straw and cake reached the same market weight as a lot fed waste alfalfa the first winter and good alfalfa the second. In the third experiment a lot on a full ration of silage alone (32 lbs. as calves and 47 lbs. as yearlings) made fair gains in the winter, but the final weight attained was only 1,187 lbs. per head, whereas

the lot fed the same silage ration plus 2 lbs. of cottonseed cake had a final weight of 1,308 lbs. In the same experiment steers fed alfalfa alone weighed 1,240 lbs. at the end, and steers fed alfalfa and a limited silage ration weighed 1,272 lbs.

In each experiment one or two lots were fed barley in conjunction with alfalfa or alfalfa and silage, and were marketed at the end of the second winter. The gains were not uniformly satisfactory and the practice is not recommended, since the cheap gains on pasture in the second summer are sacrificed.

The thinnest cattle at the end of the winter made the heaviest summer gains and thereby recovered about 55 per cent of the difference between their weights and the weights of the heavily fed cattle.

A progress report is included of the results of the first winter (1921) of a fourth experiment. This involves comparisons of full, medium, and light feeds of alfalfa and tests of three kinds of silage. Proximate analyses of the corn silage and the pea-and-barley silage fed in this test are tabulated.

Shelter and warm water for fattening steers, E. L. POTTER and R. WITCOMBE (*Oregon Sta. Bul. 183 (1921), pp. 11, figs. 6*).—This is a report of four winters' experiments, two with 2-year-old steers and two with calves, beginning in 1917-18 at the Eastern Oregon Substation, and involving comparisons between the open feed lot and a barn or shelter for feeding. Alfalfa hay and either pea or barley silage were fed to all the animals, and the calves also received limited amounts of barley. The barn shelter of the steers and the open shed for the calves resulted in negligible increases in the gains.

The steer experiments included a third lot which were fed in the open, but provided with warm water for drinking purposes. The gains and feed consumption were practically identical with those of the cold water lot.

Flushing and other means of increasing lamb yields, F. R. MARSHALL and C. G. POTTS (*U. S. Dept. Agr. Bul. 996 (1921), pp. 14*).—This is a study of the factors concerned in the production of twin lambs by ewes, particularly methods of feeding the ewes, and the influence of age, breed, etc.

In experiments with Southdown ewes, conducted at the U. S. Experimental Farm, Beltsville, Md., and at the U. S. Morgan Horse Farm, Middlebury, Vt., the lamb crop of 7 lots of ewes fed so as not to gain appreciably in weight averaged 128.8 per cent, while 7 lots fed grain and 3 given extra pasture had an average lamb crop of 146.9 per cent. These percentages are based only on ewes which actually gave birth to lambs. The flushed ewes made an average gain of 7.98 lbs. during the breeding season; the unflushed ewes averaged 1.76 lbs. gain. The flushed ewes also tended to come into heat more rapidly.

Flock records of the Bureau of Animal Industry show that the proportion of twin births rises gradually until the ewes are 5 or 6 years old, after which there is a decrease. In a breed comparison based upon the records of 189 flocks in the seasons of 1919 and 1920, the percentages of lambs dropped were as follows: Dorset 158, Lincoln 157, Oxford 152, Southdown 151, Shropshire 149, Hampshire 144, Cotswold 144, Tunis 141, and Rambouillet 122. The order of breeds was the same for 2-year-olds as for aged ewes. Examination of the Southdown records did not indicate that a ewe or a ram born a twin tends to produce a high proportion of twins.

Data on the growth of single lambs and twins are tabulated. At the end of 12 months single lambs averaged 105.8 lbs. in weight, twin lambs raised as twins 109.5 lbs., and twin lambs raised as singles 105.2 lbs.

Silage for fattening lambs, R. WITCOMBE and E. L. POTTER (*Oregon Sta. Bul. 184 (1921), pp. 7, figs. 4*).—Two winter tests at the Eastern Oregon Sub-

station involving 172 and 208 lambs, respectively, are reported. The lambs received a ration of 1 lb. of barley and all the alfalfa hay that they would eat and in addition half of them were given 1 lb. of silage per day. In 1918-19 the silage was made of peas and bald barley and in 1920-21 it was sunflower silage. The silages did not increase the gains materially, but the authors estimate that 1 ton of the pea-and-barley silage replaced 140 lbs. of barley and 824 lbs. of alfalfa hay, and that a ton of the sunflower silage replaced 80 lbs. of barley and 740 lbs. of hay.

Field peas for pork production, R. E. GONGWER (*Idaho Sta. Bul. 125 (1921)*, pp. 8, fig. 1).—The author summarizes hogging-off experiments with peas conducted in 1915, 1916, and 1920, which have been noted from preliminary reports in Bulletins 84, 92, and 122 (E. S. R., 34, p. 767; 37, p. 66; 45, p. 271) and gives results of a dry lot test of barley and peas which has also been noted from Bulletin 122.

In the grazing tests it was found that both spring and fall pigs make satisfactory growth on field pea pastures, the gains being more rapid but not more economical when a supplementary ration of rolled barley is fed.

Nutrient requirements of growing chicks: Nutritive deficiencies of corn, F. E. MUSSEHL and J. W. CALVIN (*Jour. Agr. Research [U. S.], 22 (1921), No. 3*, pp. 139-149, figs. 11).—The authors report an experiment at the Nebraska Experiment Station conducted in cooperation with D. L. Halbersleben and R. M. Sandstedt in which 10-day old White Leghorn chicks were fed in lots of 9 for upward of 126 days. Yellow corn was fed with or without supplement to 10 of the 11 lots considered.

Neither corn alone nor corn and a complete ash mixture produced more than scanty growth. The corn and ash ration was improved very slightly or not at all by the addition of casein, corn gluten, or soy beans, and no further improvement came from the addition of butter fat to the casein or corn gluten mixtures. However, the addition of wheat greens to the corn-casein-ash combination resulted in satisfactory growth, and a still better growth was obtained from wheat, casein, butter fat, and ash fed in conjunction with wheat greens.

The chicks died very early when given gelatin or egg white mixed with corn and butter fat, due it is thought to the sticky condition of the feed.

Egg-laying characteristics of the hen, J. DRYDEN (*Oregon Sta. Bul. 180 (1921)*, pp. 96, figs. 26).—The author reports the results of extensive selection experiments begun in 1908. The foundation stock consisted of Barred Plymouth Rocks and Single Comb White Leghorns. Crosses were also made between the breeds, and the crossbreds, after further selection to establish uniformity, were designated Oregons. Including eggs laid outside the trap nests the average production in the pullet year was 201 eggs for the Oregons, 164 for the Plymouth Rocks, and 184 for the White Leghorns.

In some years only mass selection was practiced on the basis of trap nest records, but in most cases the birds were pedigreed. Considerable increase in the average annual egg yields occurred as a result of eliminating the poorer producers each year, but selection did not seem to reduce the variability to any great extent. Either the best two months' record or the egg record during March and April was found to give a sufficiently accurate indication of the annual production to constitute a satisfactory basis for culling. Birds with high pullet records tended to give higher records in the second and subsequent years than birds with low pullet records, although the percentage decrease in the second year was greater.

A preliminary report on the relation between rate of laying and chemical composition of the egg is included. The average fat content of the eggs of 10 birds rated as poor producers was somewhat higher than the fat content of the eggs of 8 birds considered high producers.

Standard varieties of chickens.—IV, The ornamental breeds and varieties, R. R. SLOCUM (*U. S. Dept. Agr., Farmers' Bul. 1221 (1921), pp. 28, figs. 26*).—Brief characterizations similar to those in previous publications of this series (*E. S. R.*, 41, p. 676) are given of the Polish, Hamburg, Game, Sumatra, Sultan, and Frizzle breeds and their recognized varieties.

Contributions to the matter and energy exchange of birds, P. HÁRI (*Biochem. Ztschr.*, 78 (1917), No. 5-6, pp. 313-348).—The author reports 11 series of respiration calorimeter experiments involving four geese. The fasting metabolism was studied in 6 of the series and in the others a ration of 100 gm. of corn meal was fed. Three series were conducted at a temperature of about 16° C.; the others at 27 or 28°. A respiration chamber of the Rubner type was used. The excreta were collected without attempt to distinguish between urine and feces, and were sampled for nitrogen analysis and for determination of energy content in a modified Berthelot-Mahler bomb. To prevent contamination of the excreta with bits of feathers the tails were clipped and the birds were covered with a thin silk jacket provided with openings for the head and feet. The body surface was estimated from the two-thirds power of the body weight by use of the factor 10.45.

The respiratory quotient during fasting varied from 0.711 to 0.835, with a mean of 0.764. The oxygen consumption during the feeding experiments was determined for only 2 series. In these the respiratory quotient varied from 1.024 to 1.283. In neither case was the respiratory quotient influenced by the temperature. The energy exchange during fasting at 27° varied from 682 to 1,038 calories per square meter of body surface. At 16° it was from 10 to 13 per cent greater. During feeding the energy output was about 50 per cent greater than during fasting without much regard to temperature. The protein catabolized in 24 hours during fasting varied from 14.2 to 36.8 gm. per square meter of body surface and the fat catabolized varied from 7.2 to 100.1 gm.

Further contributions to the matter and energy exchange of birds, P. HÁRI and A. KRIWUSCHA (*Biochem. Ztschr.*, 88 (1918), No. 5-6, pp. 345-362).—The authors report metabolism studies of two ducks operated on to permit the separate collection of urine and feces. The experimental procedure was essentially the same as that used in the studies with geese noted above, and detailed comparisons are made between the two species.

During fasting the respiratory quotient varied from 0.7 to 0.976. It is believed that the high maximum value is due to experimental error. When the ducks were being fed a ration of 50 gm. of corn meal, the respiratory quotient varied from 1.081 to 1.376. Per square meter of body surface the two ducks produced per day during fasting 276 and 240 gm. of carbon dioxid, respectively, and during the feeding periods 520 and 483 gm. The corresponding oxygen consumption was 253 and 200 gm. during fasting and 312 and 300 gm. during periods of feeding. The respective energy production during fasting was 935 and 735 calories per square meter of body surface. During feeding the energy output was increased 33 and 61 per cent, respectively. However, in each case the increase was about 32 per cent of the energy intake in excess of that required for fasting metabolism. There was essentially the same proportionate increase in the energy exchange of geese.

During fasting the ducks excreted, respectively, 0.28 and 0.34 gm. of nitrogen in the urine and during feeding 0.66 and 0.64 gm. During feeding the carbon

balance varied from 3.16 to 7.08 gm. (5 observations). This corresponds to a daily fat deposition of from 4.13 to 9.16 gm.

On the utilization of corn by chickens, ducks, and geese, K. SZALÁGYI and A. KRIWUSCHA (*Biochem. Ztschr.*, 88 (1918), No. 4, pp. 286-291).—The authors report digestion and nitrogen-balance trials with the two ducks used in the experiments noted above and four hens also operated on to permit the separate collection of feces and urine. Comparisons with the geese used in Hári's experiments are included.

The hens digested 84.4 per cent of the nitrogen in the corn meal and the ducks 85.4. The same ducks in the experiments of Hári and Kriwuscha digested 84.6 per cent of the nitrogen of corn meal. The hens absorbed 88.9 per cent of the chemical energy of the feed and the ducks 87.7. The similarity of these digestion coefficients to those determined by various authors for swine fed corn is pointed out.

Flying homer pigeons, A. J. MACSELF (*London: Country Life; New York: Charles Scribner's Sons, 1920, pp. 32*).—A practical account for pigeon breeders.

On the relationship between the formation of yolk and the mitochondria and Golgi apparatus during oögenesis, J. B. GATENBY and J. H. WOODGER (*Jour. Roy. Micros. Soc.*, No. 2 (1920), pp. 129-156, pl. 1, figs. 4).—This is a review of recent progress in the study of the formation of the yolk in the eggs of animals by the use of modern cytological methods, with a bibliography of 44 titles in this field and a glossary of the names that have been proposed for the various inclusions in the cell body.

In all cases where the Golgi apparatus has been adequately studied, it occurs in the oögonium and persists with little change in the full-grown oöcyte. In ascidians and certain mollusks it may contribute to the yolk spheres, but there appears to be no evidence that it is concerned with yolk formation in the vertebrate egg. The mitochondria, on the other hand, can and do metamorphose into bodies possessing the microchemical reactions of fat, and seem to be a common but not exclusive source of the yolk.

The problem of synapsis, L. HOBGEN (*Jour. Roy. Micros. Soc.*, No. 3 (1920), pp. 269-276).—In this survey of the controversy concerning parasynapsis and telosynapsis, the author comes to the conclusion that the major premise of the chromosome hypothesis, the reality of synapsis itself, has been unduly ignored by investigators and is in no sense firmly established. As to the question of individuality of the chromosomes, the author is inclined to agree with those who hold that the loss of individuality during the resting periods is only apparent.

DAIRY FARMING—DAIRYING.

Sunflower silage for dairy cattle, G. R. QUESENBERRY, O. C. CUNNINGHAM, and I. FOSTER (*New Mexico Sta. Bul. 126* (1921), pp. 15-17).—Silage made from Russian sunflowers was compared with corn silage in an experiment with four cows (Jerseys and Guerneys) divided into two groups and fed by the reversal method during two periods of 22 days. The average ration consisted of 6.75 lbs. of grain, 14.5 lbs. of alfalfa hay, and 29 lbs. of silage. The cows produced 21.76 lbs. of milk per head daily during the feeding of sunflower silage and 27.02 lbs. during the corn silage period. In the latter period the gain in weight was also somewhat greater.

In a similar comparison between sunflower silage and cane silage reported in less detail the periods were 35 days each and the milk production was somewhat higher when sunflower silage was fed.

Studies in milk secretion.—IX, On the performance of the progeny of Holstein-Friesian sires, J. W. GOWEN and M. R. COVELL (*Maine Sta. Bul. 300*

(1921), pp. 121-252, figs. 2).—This is a study of the relative values of Holstein-Friesian sires as shown by the production records of their daughters, and is based on the 449 bulls that had at least 2 daughters admitted to advanced registry with 365-day tests in the years 1903-1919. To make the comparisons fair each milk record was corrected to a standard age of 8 years by means of the algebraic equation derived in the preceding publication of this series (E. S. R., 44, p. 675), but the fat percentages were not corrected since they change but little with age. Tables give the average corrected milk yield, the average fat percentage, and the average corrected fat yield of the daughters of each sire, and also an indication of the uniformity with which the sire transmitted productive capacity to his daughters. To secure the latter, the daughters of all the bulls considered were divided into 8 groups of equal size (octiles) according to their production records. From highest these are designated by the letters *I, J, . . . , O*. A sire's transmitting ability is indicated by a symbolic sum of the letters necessary to designate the octiles of his daughters, with each letter preceded by a number representing the percentage of the daughters falling within the limits of the octile. E. g., the milk records of the 37 daughters of King of the Pontiacs is expressed thus:

$$16I+41J+22K+8L+5M+5N+3O$$

A table also compares sires and sons on the basis of the records of their respective advanced registry daughters.

The sires were divided into several groups according to the milk and fat records of the daughters, and in each group the inbreeding and relationships were studied by means of Pearl's coefficients. However, there were no indications of significant differences between the groups in inbreeding or in degree of relationship between sire and dam.

A study of the chlorin content of milk and blood after the ingestion of sodium chlorid. W. DENIS and W. R. SISSON (*Jour. Biol. Chem.*, 46 (1921), No. 3, pp. 483-492, figs. 2).—In experiments with lactating goats it was found difficult to increase the chlorin content of the milk by feeding sodium chlorid. However, when the salt was administered in amounts sufficient to produce an 18 per cent increase in the chlorin content of the blood plasma the chlorin content of the milk was also raised. Coincident with the increase in the chlorin concentration the volume of the milk became greatly diminished.

Eighth and ninth annual reports of the International Association of Dairy and Milk Inspectors, edited by I. C. WELD (*Internatl. Assoc. Dairy and Milk Insp. Ann. Rpts.*, 8 (1919), pp. X+11-246; 9 (1920), pp. 237).—These volumes constitute the proceedings of the meetings held in December, 1919, and October, 1920, in New York and Chicago, respectively.

The 1919 volume contains the following committee reports: On organization and administration of milk control, by W. H. Price (pp. 41-50); on dairy farm inspection, by J. A. Gamble (pp. 51-58); on methods of bacterial analyses of milk and milk products, by G. E. Bolling (pp. 59-62); on food value of milk and milk products, by G. B. Taylor (pp. 74-87); on remade milk (noted below); on transportation and marketing of milk and milk products, by R. S. Smith (pp. 159-163); on pasteurization of milk and cream, by F. J. Moore (pp. 164-166); and on construction of dairy buildings and its relation to sanitation, by E. Kelly (pp. 181-186). Besides some papers noted below, the following independent articles are included: The Milk Situation in Philadelphia, by C. B. Lane (pp. 63-70); Studies on the Composition of Market Milk in Massachusetts, by C. E. Marsh (pp. 154-158); The Role of the Bovine Type of Tubercle Bacillus in Human Tuberculosis, by C. Krumwiede (pp. 167-175); Dairy and Milk Inspection in California, by C. L. Roadhouse (pp. 176-180);

The Milk Supply of Newport, R. I., by J. F. Johnston (pp. 187-192); and The Milk Supply of New York City, by O. Salthe (pp. 243-246).

The 1920 report includes the following reports of committees: On bovine diseases—their relation to the milk supply and to the public health, by H. Young (pp. 39-44); on remade milk (noted below); on food value of milk, by G. B. Taylor (pp. 124-131); on dairy methods, by T. J. McInerney (pp. 132-142); on transportation and marketing of milk and milk products, by R. S. Smith (pp. 160-171); on methods of bacterial analyses of milk and milk products, by G. E. Bolling (pp. 195-197); and on pasteurization of milk and cream, by C. E. Clement (pp. 215-221). The following are among the independent papers included: Some Economic Problems in Milk Handling of Interest to Milk Inspectors, by C. E. Clement (pp. 68-73); The Origin, History, and Development of the Ayrshire Cattle, by J. G. Watson (pp. 112-117); The Origin, History, and Development of the Guernsey Cattle, by W. H. Caldwell (pp. 118-123); Plan Adopted and Results Obtained in Grading the Milk Supply of Richmond, Va., by T. J. Strauch (pp. 154-159); The Dairy Situation of This and Other Countries, by C. W. Larson (pp. 172-179); The Relation of Labor to the Production and Sale of Milk, by J. O. Jordan (pp. 180-187); Summary of Work Done in Boston Milk Campaign, Cost of Same, and Some Results, by W. P. B. Lockwood (pp. 188-194); Milk Plant Control, by B. Vener (pp. 198-203); A Successful Farmers' Cooperative Milk Plant [at Kane, Pa.], by L. B. Cook (pp. 204-207); and The Milk Inspector's Duty to the Public, by H. A. Harding (pp. 208-214). Three other papers are based upon material previously noted in more complete form, namely, Ropy Milk, by H. A. Harding and M. J. Prucha (pp. 76-80) (E. S. R., 44, p. 676); The Keeping Quality of Milk as Judged by a pH Method, by L. H. Cooledge (pp. 149-153) (E. S. R., 43, p. 681); and The Little Plate Method of Counting Bacteria in Milk, with Special Reference to a Field Outfit, by W. D. Frost (pp. 234-237) (E. S. R., 45, p. 175).

The milk inspector and milk plant operation, C. E. CLEMENT (*Internatl. Assoc. Dairy and Milk Insp. Ann. Rpt.*, 8 (1919), pp. 206-215).—The author discusses the qualifications of milk plant inspectors, and cites data collected by the Dairy Division of the U. S. Department of Agriculture as to the type of pasteurizers used in city milk plants in the United States (E. S. R., 42, p. 673) and the number of men employed in plants of various sizes.

Bacterial control in milk plants, R. S. SMITH (*Internatl. Assoc. Dairy and Milk Insp. Ann. Rpt.*, 8 (1919), pp. 223-239; also in *Jour. Dairy Sci.*, 3 (1920), No. 6, pp. 540-554).—From observations and bacteriological examinations made by the Dairy Division, U. S. Department of Agriculture, of 92 milk plants located in 27 cities, the author cites data showing the increase in the bacterial contamination of milk during cooling after pasteurization, bottling, and storage.

The washing of bottles and milk cans by mechanical means usually results in greater biological cleanliness than hand washing. However, in plants where hand washing was practiced there were usually no facilities for adequate steaming. The bottle cap as a source of contamination is also considered. The author concludes that it is possible and thoroughly practicable on a commercial scale to have containers for milk substantially sterile.

The use of chlorinated lime in the sterilization of milk utensils, G. B. TAYLOR (*Internatl. Assoc. Dairy and Milk Insp. Ann. Rpt.*, 8 (1919), pp. 193-205).—The author reports practical experiments made in the Dairy Division of the U. S. Department of Agriculture in the use of commercial chlorinated lime (bleaching powder) to sterilize milk cans and bottles. Complete sterilization resulted from a 1-minute immersion in a solution containing 1 part of available chlorin to 5,000 parts of water, provided the utensils had been

washed to remove traces of milk. The cans were not injured if promptly drained. The 30 per cent of available chlorin in the usual commercial preparations was found entirely soluble in water. A 1:5,000 solution remained stable when kept out of the sunlight. If used daily to sterilize washed cans and bottles (but not the rubber parts of milking machines), the solution retains a satisfactory germicidal action for about a week.

In making the solution the powder is first added to a small amount of water, which is then filtered through cotton flannel to remove the insoluble calcium salts and finally diluted to the required strength.

The value of the bacterial count in raw and pasteurized milk and milk products, C. H. KILBOURNE (*Internatl. Assoc. Dairy and Milk Insp. Ann. Rpt.*, 9 (1920), pp. 101-111; also in *N. Y. Prod. Rev. and Amer. Creamery*, 52 (1921), No. 15, pp. 846-849).—This is a discussion based upon an investigation of variations in bacteriological counts in different laboratories previously noted (*E. S. R.*, 41, p. 573). Some additional data are reported.

A study of the bacteriological examination of grade "A" (certified) milk, K. FREEAR, A. T. R. MATTICK, and R. S. WILLIAMS (*Jour. Hyg. [Cambridge]*, 20 (1921), No. 2, pp. 125-131).—Continuing the work of Freear, Buckley, and Williams (*E. S. R.*, 44, p. 74), the authors report bacteriological studies of high-grade milk produced on four farms for the purpose of determining the practicability of possible changes in the standards for certified milk in England. It is concluded that reducing the maximum plate count from 30,000 to 10,000 would be an undue hardship to the dairy farmer, particularly in view of the fact the milk often does not reach its destination for 30 hours.

Report of committee on remade milk, I-IV (*Internatl. Assoc. Dairy and Milk Insp. Ann. Rpt.*, 9 (1920), pp. 45-67; also in *N. Y. Prod. Rev. and Amer. Creamery*, 52 (1921), Nos. 14, pp. 818-820, 822; 15, pp. 866-868; 16, pp. 892, 893).—This report is divided into four sections, as follows:

I. *Commercial aspects of remade milk—Data from manufacturers of powdered milk and opinions expressed*, G. B. Taylor.—Replies are summarized from a questionnaire sent to manufacturers of powdered milk. It is concluded that most milk powder is sold mainly to ice-cream factories, bakers, and confectioners in the larger cities, and that only a small fraction is used for the manufacture of remade milk.

II. *Statement regarding experiments using remade milk as a food for infants*, J. O. Jordan.—This is a note on the health of the three groups of babies used in the experiments reported by Price in the 1919 report noted above.

It is concluded that remade milk composed of skim milk powder and unsalted butter forms a very satisfactory diet for short periods, and it is recommended where the local milk supply is of uncertain sanitary quality. The babies on the milk-powder diets did not develop scurvy and rickets at any greater rate than those fed grade A whole milk.

III. *Progress report of experiments for developing methods of detecting remade milk*, O. L. Evenson.—Brief reviews are given of methods of detecting mixtures of remade milk and natural milk reported in the literature and some tested in the Food Control Laboratory of the U. S. Department of Agriculture. Tests discussed include H-ion concentration, surface tension, rennet test, freezing point and molecular concentration constant, soluble albumin, the nitrate test, and the rate of extraction of fat. The rennet test and the tests for nitrates are considered the most promising.

IV. *General conclusions of the committee*, L. W. Ferris.—Besides a summary of the committee's report these pages include stenographic reports of discussions from the floor.

Report of committee on remade milk, I-V (*Internatl. Assoc. Dairy and Milk Insp. Ann. Rpt.*, 8 (1919), pp. 107-153).—This report is divided into five sections, as follows:

I. *Commercial and economical aspects of remade milk*, C. W. Eddy.—The committee thinks that remade milk will prove valuable in time of shortage, but that its manufacture on a commercial scale would ordinarily be too costly, assuming that only materials suitable for human consumption are to be used.

II. *Effect of remade milk on the dairy industry*, G. B. Taylor.—Twenty replies are summarized to a questionnaire sent to heads of dairy departments of agricultural experiment stations in the United States. In most of the replies the view was taken that the powdered-milk industry would prove a benefit to dairy farmers and manufacturers by helping to stabilize the market for dairy products and by providing an outlet for surplus milk.

III. *Results of feeding infants on remade milk*, W. H. Price.—Previously noted from another source (*E. S. R.*, 43, p. 566).

IV. *Legislative restrictions necessary for remade milk*, A. F. Stevenson.—“The need of official control of dried milk, condensed milk, and butter factories is great, and these industries should be required to conform to all the regulations prescribed for the production of fluid market milk before their products are accepted as fit for use in the manufacture of remade milk.”

V. *General conclusions of the committee*, H. W. Redfield.—Most of this section also deals with legislative restrictions proposed by the committee, including the establishment of bacteriological standards for the products from which remade milk is prepared and regulations forbidding the addition of preservatives or any other substances except sugar and a small amount of calcium hydrate.

The relation between grade claimed and actual grade of butter purchased in the retail market, G. F. REDDISH (*Jour. Dairy Sci.*, 4 (1921), No. 4, pp. 286-293).—The author tabulates the score, commercial grade, grade claimed by the retailer, retail price, and wholesale price of 73 samples of butter, and concludes that the quality claimed and the retail prices are in no sense correlated with the actual grade and the established wholesale prices of butter of the same quality.

Microscopic study of bacteria in cheese, G. J. HUCKER (*Jour. Agr. Research* [U. S.], 22 (1921), No. 2, pp. 93-100, pl. 1).—This is a note from the New York State Experiment Station concerning the preparation of cheese for microscopic examination for the purpose of studying the distribution of bacteria and making direct counts of their numbers. The method is that adopted by histologists, viz, embedding in paraffin, cutting serial sections with a rotary microtome, and mounting on slides. The sections are stained with methylene blue or by the Gram method. The embedding process is stated to cause only slight shrinkage. The number of bacteria per gram can easily be computed from a count of the bacteria in the field of a microscope if the thickness of the section and the diameter of the field are known.

The plate counts were in all cases very much lower than the direct counts. The discrepancy is attributed to the difficulty of liberating organisms from the cheese mass prior to plating. The plate cultures also failed to reveal the various types of organisms present in their true proportions, since the usual lactose medium favors the growth of the *Streptococcus lactis* group. The possibilities of using the direct microscope method to study the rôle of specific organisms in cheese ripening is pointed out.

Availability and usefulness of dairy statistics, R. C. POTTS (*Jour. Dairy Sci.*, 4 (1921), No. 4, pp. 342-349).—Illustrations are cited showing the usefulness of the reports on dairy marketing conditions and other dairy statistics issued by the U. S. Department of Agriculture.

VETERINARY MEDICINE.

Veterinary hygiene.—I, **Hygiene and infectious diseases of farm animals**, M. KLIMMER (*Veterinärhygiene.*—I, *Gesundheitspflege und Allgemeine Seuchenlehre der Landwirtschaftlichen Nutztiere*. Berlin: Paul Parey, 1921, 3. ed., rev. and enl., vol. 1, pp. XII+428, figs. 270).—This is the third edition of this work (E. S. R., 32, p. 79).

Veterinary obstetrics, R. SCHMALTZ (*Das Geschlechtsleben der Haussäugetiere*. Berlin: Richard Schoetz, 1921, 3. ed., pp. XII+529, figs. 67).—A third edition of this work.

Eighth biennial report of the Kansas Live Stock Sanitary Commissioner, 1919–1920, J. H. MERCER (*Kans. Live Stock Sanit. Commr. Bien. Rpt.*, 8 (1919–20), pp. 98, figs. 12).—This biennial report includes an account of the occurrence of infectious diseases of live stock and control work therewith.

Annual report for 1920 of the principal of the Royal Veterinary College, J. MCFADYEAN (*Jour. Roy. Agr. Soc. England*, 81 (1920), pp. 222–230).—This consists largely of information on the occurrence in Great Britain of anthrax, glanders, swine fever, foot-and-mouth disease, rabies, parasitic mange in horses, abortion in mares, and tuberculosis. During the year 1920 there were 93 outbreaks of foot-and-mouth disease in England, a number which has been exceeded but once during the last 36 years, namely, in 1892, when there were 95. The distribution of these outbreaks by counties in point of time is reported in tabular form.

Digest of comments on the Pharmacopœia of the United States of America and on the National Formulary, A. G. DUMEX (*Pub. Health Serv. U. S., Hyg. Lab. Buls.* 125 (1920), pp. 340; 127 (1921), pp. 356).—These bulletins continue the series previously noted (E. S. R., 42, p. 566) for 1917 and 1918, respectively.

Pine-oil and pine-distillate product emulsions: Method of production, chemical properties, and disinfectant action, L. P. SHIPPEN and E. L. GRIFFIN (*U. S. Dept. Agr. Bul.* 989 (1921), pp. 16).—This publication reports the results of an investigation undertaken for the purpose of obtaining data to assist in the detection of the adulteration of commercial pine oil and other pine distillation products, and of determining the validity of statements concerning the deterioration of pine-oil disinfectant and its behavior against certain pathogenic organisms. Descriptions are given of the destructive distillation, steam distillation, and steam and solvent processes for the preparation of pine oil, and data are reported on the composition of known samples of oil prepared in the three ways.

The steam and steam-and-solvent process oils, although obtained from widely separated localities, were quite similar in composition. The densities of the six samples examined varied from 0.927 to 0.945, and the refractive indices from 1.4820 to 1.4870 (Abbé refractometer at 20° C.) The moisture in no case exceeded 1 per cent nor the resinous material 0.5 per cent. Distillation between 190 and 220° gave a yield of oil varying from 87.6 to 94.6 per cent.

The six samples of destructive-distillation pine oils examined varied much more in their properties. The densities varied from 0.886 to 0.949, refractive indices from 1.4868 to 1.5035, and the distillate between 190 and 220° from 32.4 to 98 per cent. Only traces of moisture were found, and the resinous matter varied from 0.02 to 12.5 per cent.

Similar analyses are reported of 12 commercial samples of other oils obtained in the destructive distillation of wood, including wood naphtha, crude light oil, heavy crude oil, entire crude oil, and tar oil. These oils were characterized in general by a high content of resinous matter and phenols and an unpol-

merized residue of less than 1 per cent. As none of the pine oils examined gave an unpolymerized residue of more than 2 per cent and petroleum oils give high polymerization residues, this determination is suggested for detecting the adulteration of pine oil with kerosene or other mineral oil fractions.

Emulsions prepared from the various samples by the method given for Hygienic Laboratory pine-oil disinfectant described by Stevenson¹ were tested for bactericidal efficiency by the Hygienic Laboratory method, using in some cases the Rideal-Walker technique. Freshly prepared emulsions of steam-distilled pine oils gave Hygienic Laboratory coefficients varying from 3.42 to 4.34, with an average of 3.88. At the end of 12 months the average was 3.66. Emulsions of destructively-distilled pine oil gave coefficients of from 1.71 to 3.42, while emulsions from the other oils gave coefficients under 1. These preparations failed to emulsify completely in 10 per cent concentration.

Emulsions from various grades of pine oils failed to kill *Micrococcus aureus* and *Bacillus anthracis* in any dilution capable of emulsification. The emulsions were not uniform in killing *B. typhosus* in a 1:500 dilution in 15 minutes, and two failed to kill in 1:400 dilution in this length of time. In view of these results the authors are of the opinion that pine-oil products should not be used in general for disinfecting purposes, and when used against *B. typhosus* should be employed in a solution of five times the strength capable of killing the organism in 5 minutes. If such a solution does not remain completely emulsified, it should not be used as a disinfectant. A list of 33 references to the literature is appended.

Hydrocyanic acid in Sudan grass, C. O. SWANSON (*Jour. Agr. Research* [U. S.], 22 (1921), No. 3, pp. 125-138).—This contribution from the Kansas Experiment Station reports further tests for the presence of hydrogen cyanid in Sudan grass, supplementing the preliminary report previously noted (E. S. R., 45, p. 179). The Prussian blue method was adopted as best suited for the present investigation, the amount of hydrogen cyanid obtained from 200-gm. weights of different samples being estimated colorimetrically, using standard solutions containing known amounts of potassium cyanid.

Preliminary tests established the fact that the maximum yield of hydrogen cyanid can be obtained from the plant by macerating the material and digesting it in water at room temperature for about 6 hours or over night. Examination of different parts of the plant at various stages of growth showed that practically all of the hydrogen cyanid is in the leaves, and that more hydrogen cyanid is found in growing than in mature plants, thus corroborating the conclusion of Menaul and Dowell (E. S. R., 42, p. 610). Further evidence that the liberation of hydrogen cyanid is intimately associated with enzym action is shown by the fact that the hydrogen cyanid is liberated from the plant as soon as the plant is macerated or undergoes wilting, and that this liberation is prevented by digesting at boiling instead of room temperature and by the action of acids or alkalis.

Sorgo and kafir were found to contain much larger amounts of hydrogen cyanid than does Sudan grass. Ten-lb. portions of green sorgo when fed to horses caused no change in respiration, pulse, or temperature. The degree of acidity found in the stomach of a horse is thought to be such as would prevent liberation of hydrogen cyanid from the green material.

Methods of isolation and cultivation of anaerobic bacteria.—Studies in bacterial metabolism, A. I. KENDALL, M. COOK, and M. RYAN (*Jour. Infect. Diseases*, 29 (1921), No. 3, pp. 227-234, figs. 2).—This is a general discussion of the difficulties involved in obtaining and maintaining bacteriologically pure

¹ Pub. Health Rpts. [U. S.], 30 (1915), No. 41, pp. 3004-3008.

strains of anaerobic organisms, together with suggestions for the improvement of the method of isolation of single organisms described by Barber.² By isolating single spores from sporulated cultures previously heated to 80° C. for 10 minutes to kill all vegetative cells and incubating the medium containing the single spore in a vacuum oven for a few hours at body temperature, the authors have been able to raise the percentage of successful isolations from 1 or 2 per cent to an average of 35 per cent. Modifications of the Barber pipette and the Hall apparatus³ for anaerobic culture are described.

An improved anaerobe jar, J. H. BROWN (*Jour. Expt. Med.*, 33 (1921), No. 6, pp. 677-681, figs. 2).—A modification of the customary anaerobe jar in which oxygen is consumed by combustion with hydrogen under the catalytic action of platinized or palladinized asbestos is described. The essential features of the modification consist in heating the catalyzer by electricity after the jar is closed, and in protecting the catalyzer coil with a copper wire screen, thus introducing the principle of the Davy safety lamp and eliminating the danger of explosions. A diagrammatic illustration of the apparatus is included.

Influence of peptone on indol formation by *Bacillus coli*, F. W. TILLEY (*Amer. Jour. Pub. Health*, 11 (1921), No. 9, pp. 834-836).—The author's experiments have led him to draw the following conclusions.

"The varying composition of the different kinds of peptone available in this country may cause a typical strain of *B. coli* to give negative, weak, or strong reactions for indol, depending on the kind of peptone used and the time of incubation. It is advisable to test each new lot of peptone used in order to determine its suitability for indol production and also the optimum incubation time. A test for the presence of tryptophan will usually indicate the relative value of any given sample of peptone for use in making indol tests."

Anaphylactic reactions resulting from vaccination against anthrax by the serum-simultaneous method, W. J. TAYLOR and T. L. CASSERLY (*Jour. Amer. Vet. Med. Assoc.*, 59 (1921), No. 6, pp. 704-710, figs. 2).—Attention is called to the liability of anaphylactic reactions appearing in cattle vaccinated against anthrax in successive years by the serum-simultaneous method.

In the experience of the authors at the Panama Canal such reactions have been quite common. No means have been found for determining which animals will react. The administration of a sensitizing dose of 1 cc. of serum two hours before the regular vaccination has been found to reduce the severity of the reaction in some cases, but not to prevent reaction in susceptible animals. The anaphylactic reaction is not accompanied by a rise in temperature, and even if of a severe nature eventually subsides without treatment, but in valuable animals treatment of the more violent symptoms is recommended. Some evidence is at hand that the reaction may produce abortion, but further investigation of this point is considered necessary before definite conclusions can be drawn.

Practical results of immunization against blackleg with germ-free filtrate, E. GRÄUB (*Schweiz. Arch. Tierheilk.*, 63 (1921), No. 3, pp. 106-108).—The author reports a mortality of only 0.6 per cent following the vaccination with germ-free filtrate (E. S. R., 45, p. 180) of 4,800 cattle in the Canton of Berne in the spring of 1920. During the same season and in the same Canton 22,000 cattle were vaccinated with muscle vaccine, with subsequent mortality of 3.1 per cent. The low mortality following vaccination with germ-free filtrate is considered not only to prove the superiority of this method of vaccination, but also to indicate that the blackleg in this particular instance was due to *Bacillus chauvæi* and not to other organisms.

² Kans. Univ. Sci. Bul., 4 (1907), No. 1, pp. 3-48.

³ Calif. Univ. Pubs. Path., 2 (1915), No. 17, pp. 147-155.

The immunizing value of heat-killed hemorrhagic septicemia bacilli, R. GRAHAM and H. SCHWARZE (*Jour. Amer. Vet. Med. Assoc.*, 59 (1921), No. 5, pp. 546-557).—A contribution to the study of the immunizing value of hemorrhagic septicemia bacterins is reported which tends to confirm the conclusions of Van Es and Martin (*E. S. R.*, 43, p. 882).

Nine commercial hemorrhagic septicemia bacterins for swine plague and similar products prepared from known *Pasteurella suisseptica* strains were injected one or more times in rabbits and guinea pigs in doses proportional to the amounts used in practice, and the animals were later exposed to unattenuated virus. A total of approximately 1,000 animals including controls was used. The results reported show that neither the commercial nor the laboratory bacterins in the amounts injected protected the experimental animals against artificial exposure. In discussing these results the authors state in conclusion that "the apparently negative immunizing character of certain bacterins for swine plague will doubtless continue to demand attention of a constructive character. It is hoped that investigations will be projected until immunizing products for hemorrhagic septicemia are developed and the safest methods of use perfected. Until the manufacture of biological products is ultimately limited to those of proven value, as established by acceptable methods, discriminating judgment is a responsibility which must, of necessity, be exercised in some instances for the mutual interests of all concerned. Inactive, nonpotent, and unreliable agents can not be presented indefinitely under the guise of true immunizing products if the veterinary profession is to render the highest type of professional service to the live-stock breeder."

The piroplasmoses occurring in Indo China, H. SCHEIN (*Bul. Agr. Inst. Sci. Saigon [Chochin China]*, 3 (1921), No. 9, pp. 269-282, pl. 1).—The forms of piroplasmosis occurring in Indo China, including piroplasmosis of the ox, buffalo, sheep, horse, and dog, and their treatment are considered.

Antirabic vaccination by means of desiccated virus, R. D'AUNOY (*Jour. Infect. Diseases*, 29 (1921), No. 3, pp. 261-267).—The author reports his experience covering a period of six years in the use of the Harris method of preparing rabies virus (*E. S. R.*, 25, p. 483). With slight modifications of the original process, a virus containing from 300 to 500 minimal infective doses (for 2,400 gm. rabbits) per milligram can be readily produced. When stored in the dark at a maximum temperature of -10° C. no loss in infectivity of the desiccated virus could be demonstrated for periods over two years. At higher temperatures infectivity is rapidly lost, never lasting at room temperature longer than about 60 days.

The paths of spread of bacterial exotoxins with special reference to tetanus toxin, F. H. TEALE and D. EMBLETON (*Jour. Path. and Bact.*, 23 (1919), No. 1, pp. 50-68).—Experiments noted in this paper show "that although tetanus toxin ascends to the central nervous system by way of the axis cylinders of the nerves, it also to a very great extent passes up the nerves to the cord by way of the perineural lymphatics. Blocking of the latter paths greatly delays and in some cases completely prevents the occurrence of tetanus in the part corresponding to the nerve whose lymph path has been blocked.

"Although tetanus toxin passes rapidly from the blood vessels into the connective-tissue spaces and thence to the thoracic duct, the toxin does not pass from the capillaries of the central nervous system to the tissues thereof. Tetanus toxin does not pass from the choroidal plexus to the cerebrospinal fluid.

"Although bacteria can pass through the posterior root ganglion to the cord, colloidal pigments and tetanus toxin are prevented from doing so. Iodin, although it prevents tetanus toxin from producing its characteristic effects when

iodized toxin is inoculated subcutaneously or intravenously, does not effect the toxin when inoculated intracerebrally, it does not hinder the occurrence of the typical symptoms of cerebral tetanus, and there is no apparent diminution in its toxicity.

"Tetanus antitoxin does not pass to the central nervous system either by way of the blood vessels, axis cylinders, or neural lymphatic channels. It also can not pass from the cerebro-spinal fluid when inoculated intrathecally into the substance of the cord. The antitoxin simply acts by combining with the circulating toxin, and that at the seat of production, and prevents it from reaching the central nervous system. The toxin already in this position is unaffected."

Lectures on the bacteriology, immunity, specific diagnosis, and therapy of tuberculosis, E. LÖWENSTEIN (*Vorlesungen über Bakteriologie, Immunität, Spezifische Diagnostik und Therapie der Tuberkulose*. Jena: Gustav Fischer, 1920, pp. VIII+476, pls. 2, fig. 1).—This is a very complete reference book on tuberculosis designed for the use of physicians and veterinarians. Extensive literature references are included at the end of each section.

Tuberculin hypersensitiveness in nontuberculous guinea pigs induced by injections of bacillus-free filtrates, F. A. MCJUNKIN (*Jour. Expt. Med.*, 33 (1921), No. 6, pp. 751-762).—The author reports that following the intraperitoneal injection of 20 cc. of a heavy suspension of virulent tubercle bacilli in a guinea pig with well-developed peritoneal tuberculosis death occurs within 24 hours. If the fluid contained in the peritoneal sac is mixed with saline solution and passed through a Berkefeld filter, a bacillus-free filtrate is obtained which induces in normal guinea pigs a certain degree of cutaneous hypersensitiveness to tuberculin. This hypersensitiveness is also induced by a filtrate obtained by extracting with saline solution the abdominal organs and parietal peritoneum to which masses of leucocytes and tubercle bacilli are adherent.

Vaccination of cattle against tuberculosis with bile-treated bacilli, L. PANISSET (*Rev. Gén. Méd. Vét.*, 30 (1921), No. 354, pp. 313-316).—This is a general discussion of the method devised by Calmette and Guérin for immunizing cattle against tuberculosis with tubercle bacilli attenuated by bile (*E. S. R.*, 44, p. 780).

The ophthalmic tuberculin test, A. J. DEFOSSET (*Jour. Amer. Vet. Med. Assoc.*, 59 (1921), No. 6, pp. 750-754).—The author discusses the use of the ophthalmic tuberculin test as a check to the subcutaneous test, and gives detailed directions for making and recording the test.

The subcutaneous tuberculin test, C. A. CARY (*Jour. Amer. Vet. Med. Assoc.*, 59 (1921), No. 6, pp. 746-749).—Directions are given for applying and interpreting the subcutaneous tuberculin test, and its advantages and disadvantages are outlined briefly.

Combination tuberculin tests, A. J. DEFOSSET (*Vet. Med.*, 16 (1921), No. 8, pp. 23-28).—This is a discussion, based upon the author's experience in tuberculosis eradication work in Vermont of combination methods of tuberculin testing: (1) the triple subcutaneous, ophthalmic, and intradermal method; (2) subcutaneous and ophthalmic method; (3) intradermal and ophthalmic method; and (4) subcutaneous and intradermal method.

The triple combination method is recommended for certain herds with unusually bad history and in instances where the veterinarian is not thoroughly familiar with combination methods. Both the subcutaneous-ophthalmic and the ophthalmic-intradermal combinations are considered very effective, the latter being recommended as the most desirable for practicability and economy. The subcutaneous-intradermal combination is considered impracticable on account of the extra time involved in making the test, the danger of "blocking" the

subcutaneous test by heavy dosage of intradermal tuberculin, and the danger of blocking the intradermal method by injecting tuberculin subcutaneously before the intradermal observations have been completed.

The technique of each method is described, and data are given on the results obtained in testing a large number of cattle by them.

The application of the different tuberculin tests in cattle, W. H. SIMMONS (*Vet. Med.*, 16 (1921), No. 8, pp. 31-33).—Detailed directions are given for the application of the single subcutaneous, intradermal, and ophthalmic tuberculin tests and of the subcutaneous-ophthalmic and intradermal-ophthalmic combination tests.

The tuberculin test in cattle, B. DE VINE (*Vet. Rec.*, 33 (1921), No. 1726, pp. 601-608).—This is a general discussion of the tuberculin test in cattle, with illustrations from the author's experience.

The accredited herd plan, the tuberculin tests, and their relation to the practitioner, W. C. DENDINGER (*Jour. Amer. Vet. Med. Assoc.*, 59 (1921), No. 5, pp. 615-620).

The value of tissue extracts of virus pigs in the production of antihog-cholera serum, T. P. HASLAM (*Jour. Immunol.*, 6 (1921), No. 4, pp. 263-270).—The results are reported of experiments conducted at the Kansas Experiment Station to determine whether the expressed or extracted juices from the tissues of virus pigs could be used as a means of hyperimmunizing hogs in preparing antihog-cholera serum by the Dorset-Niles method.

The muscle virus was obtained from the ground meat secured under sterile conditions from the hams of virus pigs immediately after killing. Three different methods were used, as follows: (1) The ground meat was frozen and subsequently thawed in such a way that the juices flowed away drop by drop as the thawing progressed; (2) the ground meat was mixed with an equal volume of physiological salt solution and treated as in process 1; and (3) the ground meat was mixed with an equal amount of physiological salt solution, the mixture chilled, and after standing 24 hours pressed through sterile canvas by means of a small screw press. The yield by these methods was about 100, 400, and 400 cc., respectively, per pound of meat.

After attempting intraperitoneal, intravenous, and subcutaneous inoculation of the virus thus prepared, subcutaneous inoculation was adopted as the safest and most satisfactory method of hyperimmunization. The amount of virus given was 10 cc. per pound weight of the animal. The potency test of the serum from hogs hyperimmunized with muscle virus consisted in inoculating 40- to 50-lb. test pigs simultaneously with 2 cc. of ordinary defibrinated blood virus and a definite amount of the serum to be tested. Check tests were run with serum prepared from blood virus obtained from the same lot of pigs and with virus alone.

Six complete experiments were carried out, in all of which 15 or 20 cc. of the muscle virus serum, as well as of the blood serum, was able to protect 40- or 50-lb. test pigs against 2 cc. of ordinary phenolated defibrinated blood virus, while all of the checks promptly developed hog cholera. In one instance in a further test with heavy shots the serum made from the muscle virus failed to protect two of the shots receiving only 35 cc. of the serum, while those receiving the same amount of blood virus remained well. A possible explanation of the less favorable action of the muscle virus is that it had been stored in a frozen condition for several weeks prior to hyperimmunizing the hogs.

A 200,000-cc. mixture of serum prepared from muscle virus of a considerable number of animals was tested at three different times. Of a total of 24 pigs receiving from 15 to 25 cc. of this muscle virus serum and 2 cc. of ordinary

blood virus, all remained well except one which died of pneumonia. Nine pigs received 15 to 25 cc. of check serum and 2 cc. of blood virus and remained well, but 2 pigs receiving 10 cc. of check serum and 2 cc. of blood virus sickened.

The experiments reported are thought to indicate that serum of considerable potency may be prepared from muscle tissue virus.

A contribution to the study of habronemiasis: A clinical, pathological, and experimental investigation of a granulomatous condition of the horse—habronemic granuloma, L. B. BULL (*Roy. Soc. So. Aust. Trans. and Proc.*, 43 (1919), pp. 85-141, pls. 3).—This work deals particularly with studies of granulomata as found in southern Australia (pp. 87-117), including observations on the life histories of the three species of *Habronema* (*H. muscae*, *H. megastoma*, and *H. microstoma*) and animal experimentation with each, followed by accounts of granulomata as found in northern Australia (pp. 117-123), and similar granulomata as found outside Australia (pp. 123-136).

A granulomatous condition most frequently affecting the external mucous membranes of the horse in southern Australia has been found to be due to the presence of a larval nematode of the genus *Habronema*. These granulomata are found less frequently on the sheath, limbs, and probably other situations.

"The tissue reaction following the introduction of the larva gives rise to a tumor presenting a characteristic macroscopic and microscopic appearance. The larva is often very difficult to demonstrate, and is only to be found in lesions of up to about three weeks' duration. In lesions of longer standing there is usually no evidence whatsoever of the presence of the larva, but occasionally the spaces it once occupied are to be seen.

"The larva is incapable of living in the submucous, cutaneous, or subcutaneous tissues, and therefore its presence in these tissues appears to be quite accidental. Evidence suggests that these larvae are introduced from without and that they are deposited on moist surfaces during the feeding operations of *Musca domestica*, which fly acts as the intermediate host of both *Habronema muscae* and *H. megastoma*. When deposited on the external mucous membranes the larvae appear to be capable of pushing their way through the membrane and of entering the submucosa. When lesions occur on parts other than the external mucous membranes, the moisture necessary to prevent desiccation of the larvae appears to be most usually supplied by an exudation of blood or serum. This would follow some injury to the skin of the animal, either in the form of ordinary wounds or in the form of small puncture wounds made by biting flies such as *Stomoxys calcitrans*." The experiments have led the author to conclude that the larva of *H. megastoma* is the most common source, but that the other two species may also cause similar lesions.

"Prophylaxis should be in the direction of (1) ridding horses of the adult forms of the genus *Habronema* which are located in the stomach, and (2) in the destruction of horse dung or its use in agriculture. Of these two methods the second is more likely to bring success than the first and in time should accomplish what is aimed at in the first."

In an addendum the author reviews the work of Hill, previously noted (E. S. R., 43, p. 883), which came to his attention after the present paper had been submitted for publication. A list is given of 17 references to the literature.

Fowl pest (Pestis avium) in Argentina, A. ANDRIEU and C. H. BADANO (*La Peste de las Aves (Pestis avium) en la Republica Argentina. Buenos Aires: Min. Agr. Nac., Dir. Lab. e Invest. Arg. Ganaderas, 1920, pp. 19, figs. 11*).—This account includes a report of transmission experiments which demonstrated the occurrence of fowl pest in Argentina.

The efficiency of chloroform and thymol against hookworms in the silver black fox, J. A. ALLEN (*Jour. Amer. Vet. Med. Assoc.*, 59 (1921), No. 1, pp.

62-72, fig. 1).—Experiments with *Uncinaria polaris* Loos in the fox at the Fox Research Station, Health of Animals Branch, in Canada, have been summarized as follows:

"All poorly furred foxes do not harbor hookworms, but 68 per cent of the woolly and stunted foxes used in these experiments had hookworms. *Uncinaria* undoubtedly influence the fur when the parasite is present in large numbers.

"Chloroform is inefficient as an anthelmintic against hookworms in foxes. It is also a dangerous drug, producing a mortality of 50 per cent in the present experiments.

"Thymol showed a high degree of efficiency (87.8 per cent) when given to foxes on the basis of 0.13 gm. per kilogram of body weight, with this dose repeated in two hours. From this dosage a mortality of 18.7 per cent followed, which makes it rather dangerous for universal application unless a heroic attempt at eradication is necessary in ranches where infestation is heavy.

"When thymol is used on the basis of 0.065 gm. per kilogram of live weight and the dose repeated in two hours, an efficiency of at least 33 per cent may be expected, and the mortality is reduced to about 6.8 per cent. One dose of 0.065 gm. of thymol per kilogram of body weight has little or no anthelmintic effect."

A test to determine the efficiency of hookworm remedies for silver black foxes, J. A. ALLEN (*Black Fox Mag.*, 5 (1921), No. 3, pp. 3, 4, 6, fig. 1).—The data here presented are substantially noted above.

RURAL ENGINEERING.

Pump drainage of the University of Wisconsin marsh, G. R. B. ELLIOTT, E. R. JONES, and O. R. ZEASMAN (*Wisconsin Sta. Research Bul.* 50 (1921), pp. 32, figs. 15).—This bulletin contains a description of a drainage system installed in a 130-acre tract of lowland adjacent to Lake Mendota, the surface of nearly 80 acres of which is lower than the lake. It is stated that all but 5 acres has been tile drained. An electrically driven, automatically controlled pump, lifting water 7 ft. out of a reservoir into the lake, furnishes the outlet. Lines of tile generally 4 rods apart from 3 to 5 ft. deep, discharging into mains that lead to the reservoir, effect the internal drainage. A turnpike along the lake acts as a dike to keep back the lake water.

The area is a true peat bog of the alkaline type. The peat is from 1 to 6 ft. deep and lies on a thin bed of marl which in places blends into silt or clay, varying in thickness up to 18 in. Beneath this is water-bearing sand.

A report is given of the experience of 10 years, which has resulted in the present drainage system. It was found during this period that open ditches and wind and gasoline driven pumping and water lifting outfits failed. The experiment proved that if the tile could be laid deep enough and if the pumping were done at such frequent intervals that submergence of the tile outlets was prevented, the lake-level marsh could be drained and plowed. It was not until lines of tile 4 rods apart and about 4 ft. deep were laid that satisfactory drainage resulted. It was also found that the peat above the tile had shrunk with drainage and decomposition. Tile that formerly had 4 ft. of peat over them now have only about 3 ft., and those that had 3 ft. now have but little more than 2 ft.

A 24-in. breaking plow drawn by a tractor was found to be the best method of breaking the marsh. Thereafter a disk plow did better work than a moldboard plow, because the latter would not scour.

Corn proved to be the most satisfactory crop on the drained peat, and timothy and alsike proved to be good crops where the tile were unable to cope completely with excessive seepage.

Experience with the individual drains showed that a line of tile to cut off seepage effectively must have a liberal fall, and that when water is carried in a tile through a soil that would otherwise be dry the roots of willow trees will enter the tile.

An investigation undertaken in 1919 relating particularly to the shrinkage of the soil volume showed that a surface drained for six years but not tiled had settled 0.4 ft. below the marsh on the lake side of the drive. Land tiled for six years had settled about 0.75 ft. Practically all of the shrinkage had taken place in the peat above the tile, and settling of the tile themselves was comparatively small. The settlement varied with the seepage. Investigations were also conducted on frost action on tile, pump and power measurements, seepage, bacteria, cement tile, and cost of drainage.

It is concluded that the shrinkage of the peat above the tile is such that they may have to be relaid in from 10 to 20 years. Tile 3 ft. deep are too shallow. Tile 4 ft. deep and 8 rods apart are more efficient than tile 3 ft. deep and 4 rods apart. The most efficient tile in the deep peat or where seepage is great are those laid 5 ft. deep in acid peats. Well made cement tile are satisfactory in clay subsoils, but peat disintegrates some cement tile. It has not yet been proved that even the best of cement tile will stand up in acid peats unless imbedded in underlying clay.

It has been found that a simple auger pump that permits sticks and débris to pass through it without clogging or binding is the most satisfactory for drainage systems of this kind. An emergency pump for use in case of accident or unusual floods should be kept ready for action. About $\frac{1}{2}$ kw. hour is the average used per acre per 24 hours to lift the water 7 ft. in this system. The minimum was $\frac{1}{8}$ kw. hour per acre per day. The dry weather seepage amounts to about 0.1 in. in 24 hours, and the maximum requirement has been about 0.8 in. in 24 hours from the entire area.

Public Roads (*U. S. Dept. Agr., Public Roads, 4 (1921), No. 6, pp. 28, figs. 30*).—This number of this periodical contains the usual project statement under Federal-aid allowances approved in August, 1921, and the following articles:

Tests of Impact on Pavements by the Bureau of Public Roads, by C. A. Hogentogler (see below): Permissible Tolerance of Sand in Coarse Aggregates, by W. K. Hatt (see p. 187); Subgrade Drainage Tests Yield Interesting Preliminary Data, by I. B. Mullis (see p. 187); Pennsylvania Pageant Depicts Progress of Highway Transportation; and New Experimental Work Begun by the Bureau of Public Roads.

Tests of impact on pavements by the Bureau of Public Roads, C. A. HOGENTOGLER (*U. S. Dept. Agr., Public Roads, 4 (1921), No. 6, pp. 3-18, figs. 16*).—This is the first of a series of two articles, and reports the results of observations made to determine the resistance of various types of pavement to impact forces similar to those produced by the wheels of heavily loaded motor trucks. Fifty-six 7 by 7 ft. sections of standard types of pavement were used, including concrete, monolithic, semimonolithic, bituminous, and grout-filled brick with sand and screening cushions on concrete and macadam bases.

The principle controlling the design of the impact testing machine was that it should deliver a blow the effect of which would be exactly the same as that caused by the dropping of a wheel of a heavy motor truck. The machine as finally constructed consisted essentially of a loaded box riding on a 5.5-ton spring which in turn was supported by a loaded frame, on the bottom of which was a double 2 by 6 in. solid rubber tire. By means of a motor, gears, and cam this unsprung weight could be lifted and dropped from any height

so that the effect produced was identical with that of a truck dropping from one level to another. In these tests the machine was loaded to represent a 5-ton truck having 1,800 and 6,000 lbs., respectively, for unsprung and sprung weights.

In order that a comparison could be made between the effects produced by impact blows and static loads the medium used was a $\frac{1}{2}$ by $\frac{1}{2}$ in. annealed copper cylinder. By first noting the deformations produced on these cylinders by given static loads, then comparing with these static deformations the deformations of other cylinders produced by the impact blows, a comparison of the effects of impact and static forces was secured.

Curves and tables of data and mathematical analyses of the results are given. These indicate that a definite relation exists between the force of impact and the equivalent static load. The indications are that the average force of impact is one-third the maximum, and the static load which produces the same deformation of copper is double the average or two-thirds of the computed maximum.

Subgrade drainage tests yield interesting preliminary data, I. B. MULLIS (*U. S. Dept. Agr., Public Roads, 4 (1921), No. 6, pp. 22-26, figs. 5*).—The subgrade drainage experiments in progress at the Arlington experiment station of the Bureau of Public Roads are briefly described. The experiment includes 10 concrete slabs, each 14 ft. square, surrounded by ditches. It is stated that the more important indications noted to date are that (1) with deep drainage ditches unobstructed the upper layers of the soil contain more moisture than the underlying soil, a condition which is reversed by flooding the ditches, (2) treatment of the subgrade with water-gas tar or the construction of cut-off walls along the edges of the surface has a marked effect in reducing the moisture content of the upper layers of the soil, and (3) the amount of moisture near the surface is increased by alternate freezing and thawing, and marked movement of the overlying slab results from temperature changes as well as from the changes in moisture content of the subgrade.

Permissible tolerance of sand in coarse aggregates, W. K. HATT (*U. S. Dept. Agr., Public Roads, 4 (1921), No. 6, pp. 19-21, figs. 8*).—Studies conducted by the Bureau of Public Roads, in cooperation with Purdue University, the Indiana Highway Commission, and the Indiana Sand and Gravel Producers' Association, on the permissible tolerance of sand in the coarse aggregates of 1:1.5:3, 1:2:3, 1:2:4, and 1:3:6 concretes, using in each case both a fine and coarse sand, are reported.

The indications of the tests are that in the case of the material used for the first three mixtures a tolerance of 15 per cent may be allowed without substantially reducing the strength of the concrete, and that the difference in the amount of water necessary to bring the various mixes to the same workability is not sufficient to disturb the mixing operations. Concrete of the 1:3:6 proportion became too harsh with such an increase of sand.

The water resistance of treated canvas during continuous exposure to weather, F. P. VEITCH and T. D. JARBELL (*Jour. Indus. and Engin. Chem., 13 (1921), No. 8, pp. 672-676, figs. 2*).—Studies conducted by the U. S. Department of Agriculture as a part of the work on the waterproofing of cotton duck are reported, the purpose being to determine the actual relative water resistance in service of certain waterproofing preparations for treating cotton duck for outdoor use. In addition to exposure tests, laboratory tests were also made, both on the new, recently treated canvas and again after the canvas had been exposed for a year. Eighteen different treatments were tested.

It was found that when these treatments were applied to 12-oz. United States standard army gray duck, all of the treatments increased the water resistance sufficiently for use as permanent tops or covers which lie smooth, such as wagon tops, shock and hay covers, tents, and awnings. When lead oleate was included in the treatment the water resistance was increased. All three of the treatments having a rating of 100 per cent as regards water resistance contained lead oleate. Bermudez asphalt was also an effective constituent in these formulas, and was fully as good as lead oleate. Further experiments indicated that there is no material difference in this respect between Bermudez asphalt and petroleum asphalt. Copper oleate was not so effective a waterproofing agent as lead oleate. Beeswax was much more effective than any of the other hard waxes used, including paraffin and ceresin. Amorphous mineral wax was a better waterproofing agent than paraffin. Wool grease was found to be a useful constituent in formulas containing other waterproofing agents. Other results indicated that the substitution of amorphous mineral wax for wool grease in this formula did not decrease its water resistance.

In the laboratory studies it was found that both the funnel and spray tests applied to new treated duck indicated higher water resistance than is actually found in service. The waterproofing treatments which proved most serviceable on 12-oz. United States standard army gray duck also gave higher results by the funnel test. However, not all treatments showing a high rating by the funnel test proved highly serviceable in those cases where water lay for some time on the canvas. When a treatment secured the maximum rating by both the funnel and spray tests it also received a high rating in the service test. After a year's exposure, the ratings by the spray test were still high and were in general harmony with the observations made on sloping and flat sections of the canvas.

In the formulas used, paraffin, Japan wax, ceresin, candelilla wax, and rosin were not effective waterproofing materials on canvas. Although formulas containing these materials may have rated high by both the funnel and spray tests when the canvas was new, they lacked durability. It is concluded that neither the funnel test nor spray test alone is an infallible indication of the serviceability of a waterproofing treatment for canvas.

Tests of lime nitrogen fertilizer spreaders, G. FISCHER and HAGMANN (*Mitt. Deut. Landw. Gesell.*, 36 (1921), No. 23, pp. 351-358).—Tests of 15 different lime nitrogen fertilizer spreaders are reported. While the tests were competitive they were apparently not essentially comparative, since they constituted a part of a study to determine suitable methods and apparatus for the distribution of oiled and unoled lime nitrogen in and over the soil, with a minimum of nuisance occasioned by dustiness.

A preliminary analysis of what such a distributor should accomplish indicated that it should be capable of uniformly drilling and broad-spreading lime nitrogen, according to adjustment, without the development of a dusty condition. The lime nitrogen should be introduced into the distributor box without dust and should be automatically discharged. The machine should also be capable of distributing other fertilizer salts.

As a result of these studies the following suggestions and recommendations are made for the guidance of implement manufacturers: The best fertilizer distributor apparatus is the type in which a chain moves horizontally over rollers in a box and forces fertilizer through slits or holes into the discharging pipes. There is a tendency, however, for small quantities of the fertilizer to be not finely enough divided in this apparatus. Flowing fertilizer salts should not be stirred and should be moved as little as possible, and then only in the discharging apparatus.

Machines with movable slits and holes in a box which contains a shaft fitted with expelling members are useful for lime nitrogen and other dry powdery fertilizers containing no solid particles. The expelling members on the shaft must operate steadily, and the width of the slits or holes must be accurate and uniform to prevent excessive wear.

Since lime nitrogen has a tendency to adhere to flat surfaces, all surfaces along which it moves or with which it comes into contact should be vertical as nearly as possible. Pulverizing projections in the distributor box are, therefore, to be avoided. If fertilizer is to be distributed in rows over a broad surface through individual discharge conduits, the funnel walls leading to the discharges should have plenty of slope.

The surest dust protection is obtained through the use of pipe conduits. These can be so spaced as to produce both broadcast and row fertilization. Dustiness can be prevented or reduced in broadcast fertilization by slit or chain machines only by boxes which are closed at the sides as well as front and rear. The distribution openings must be so tightly constructed that no fertilizer can escape either during filling or emptying. When this is impossible, catch grooves should be provided to prevent an excess of lime nitrogen from falling on the soil. An open or half covered box is not sufficient to prevent dustiness when filling the box. Funnels placed in holes on the box top are better but are not perfect. Better results are to be expected from a closed box with valve openings as connections between the sack and the box. The construction of a dust-tight lifting and tipping arrangement for sacks is also desirable.

For large scale work the distributor should cover a width of 4 meters (13.12 ft.), and should require only one man for operation and not more than two horses for draft. A second man is permissible for steering the row fertilization apparatus. Provision should be made for opening or tipping up the box for complete cleaning, and the discharging apparatus should be easily cleaned. The apparatus for adjusting the rate and amount of fertilization should be sufficiently sensitive to permit small variations to be easily and accurately made.

Poultry house equipment, W. H. ALLEN (*New Jersey Stats., Hints to Poultrymen*, 10 (1921), No. 1, pp. 4, fig. 1).—Brief and very popular information on the equipment of poultry houses, including electric light equipment, is given.

RURAL ECONOMICS AND SOCIOLOGY.

Negro migration : Changes in rural organization and population of the Cotton Belt, T. J. WOOFER, JR. (*Thesis, Columbia Univ., New York, 1920, pp. 196, figs. 6*).—The greater part of this work is devoted to the description of land tenure and organization of farm life in the Cotton Belt and how this organization results in the movement of the population. One chapter is devoted to city movements and one to the effects of migration. The principal effort has been to describe the movements of colored people in the United States, the conditions from which they arise, and the consequences which attend them. The data on which the study is based are, in the main, worked out from the United States census. The statistical method is used, and detailed facts are presented in tables and graphs.

The chief cause of the shift in negro population from 1865 to 1910 is said to have been a discontent with the prevailing system of land tenure. After 1916 this was aggravated by war conditions and the menace of the boll weevil. Another contributing factor in the earlier period was the offer of higher wages in western States. These all contributed to the breakdown of the plantation régime and a consequent growth in number of small farms, as well as an increase in the number of farms operated by tenants.

Facts are presented which indicate that land ownership among negroes has made some headway in the coast and southwest counties of the Black Belt, but very little in the other parts of the Black Belt. It has recently extended into the Wiregrass and Upper Piedmont sections of Georgia. In all parts of the State, however, the negro holdings are small, and the tendency is toward still smaller holdings, which approximate the 20- to 50-acre or one-man farm. In regard to the farm opportunity for the negro, it is brought out that about 15,000 have become landowning farmers and 107,000 tenants, or one in each 25 negro males in the country was a landholder and one in each four a tenant. The opportunity is said to be greater in the newer Wiregrass region and in the Upper Piedmont.

A discussion of the life of the tenant classes shows that much more is involved in land tenure in the South than the technical details of farming. The unwillingness of landlords to rent or sell land and the inability of the individual to accumulate the capital necessary for the transition from laborer to tenant and share tenant to renter or owner are suggested as important factors in negro migration, especially in a region of static agricultural conditions. Any assumption that it is due to inherent race traits rather than to environment is dismissed, for it is brought out that the white population is moving in the same direction as the black.

Coefficients of correlation worked out from census figures indicate that between 1900 and 1910 (1) increases in total number of farms operated by negroes were closely associated with increase in negro population, (2) increases and decreases in number of farm laborers were almost unrelated to population movement, (3) the relationship between increases in share tenants and in population was high, (4) increases in the renter class were less closely related to population movement, and (5) increases and decreases in ownership had less effect on population movement than the other two classes of farmers.

A study of city and interstate migration shows that the route is through the villages and small towns to the large cities. Before 1910 there was very little migration from the Cotton States to northern cities. Higher wages offered there in 1916-17, better housing conditions, protection and justice in the courts, and church and school advantages contributed largely to the recent northward movement.

There is said to be, on the whole, no cause for pessimism regarding the shift of negro population. The only group of rising negro farmers which is distinctly dangerous to the economic life of the community is the independent negro renter on the land of absentee landlords. The social structure of the community is, on the other hand, strengthened by the element of independent negro farmers.

The recent rapid movement may be said to be changing the sex composition, fecundity, vitality, and crime and insanity rates; yet the general trend of the movement is toward better economic organization, religious, and educational institutions, and relations with the whites.

The author suggests a number of constructive measures which might be inaugurated by the Federal Government, the churches, private philanthropy, State governments, and local communities, these being (1) an appropriation from Congress to the Bureau of Education for permanent work in negro education to follow up certain first-hand studies which have been begun; (2) the continuation of the work of the Bureau of Negro Economics in the Department of Labor; (3) provision for research and advisory specialists concerned with the negro in agriculture to be connected with the U. S. Department of Agriculture, as well as an increase in the number of negro farm demonstrators and

study in the new field of contacts other than the mere wage or rental relationship between landlord and tenant; (4) an organization among negroes in industry along the lines of the National Urban League; (5) a return to a real and active interest in the religious welfare of the colored people on the part of the churches; (6) trials and experiments in the improvement of race relations in local communities; (7) enforcement of registration of births and deaths; (8) stricter State and city laws regarding sanitation and congestion in rental property; (9) attention to the need for State aid for high schools and for industrial and teacher-training work among the negroes; (10) more drastic measures against lynching; (11) the abolition of the system of fees to local officials on the basis of the number of arrests made, as well as of the convict lease system and the practice of sentencing to county chain-gangs; (12) the provision of State reformatories and city probation officers for colored juvenile offenders; (13) more thought and effort to be given by local editors to a negro department in their papers; and (14) the foundation in every local community of a committee composed of white and colored leaders working on problems involving race relations.

An extensive bibliography is given, and in the appendix the statistical method used and a condensed mathematical derivation of the Pearsonian coefficient are set forth.

A stake in the land, P. A. SPEER (*New York and London: Harper & Bros., 1921, pp. XXX+266, pls. 11*).—The material in this volume was gathered by the division of rural developments of Studies in Methods of Americanization, a series conducted under the direction of A. T. Burns. An introduction (pp. XV-XXVI), by R. T. Ely, is included.

The field study covered a period of about four months, from June to September, 1918, inclusive, in which time 54 cities and rural immigrant colonies in New England, the North Middle Western, the Western, and the Southwestern States were visited. Conditions were observed, and the immigrant settlers, their leaders, native neighbors, and local public officials were interviewed.

The author declares that "the establishment of a home may involve direct material assistance, but requires protection, direction, and instruction given to the home-seeking and home-building immigrants. These aspects of the problem are discussed in part 1. In the question of education the instruction of adult immigrants as well as immigrant children is important. Part 2 discusses the relative efficacy of public and private educational agencies."

Recommendations are made for the regulation of private schools and the improvement of the public school as an influence for Americanization of immigrants becoming established on the land.

French Creek as a rural community, A. J. DADISMAN (*West Virginia Sta. Bul. 176 (1921), pp. 23, figs. 27*).—This community in Upshur County, W. Va., in 1919, and also in 1920, received State-wide recognition as having the highest score, rated on a score card devised through the cooperation of specialists representing a number of State agricultural and educational agencies. The history of the settlement of this community and its pioneer families, as well as the account of its schools, churches, and community leadership, is based on information gathered under a cooperative project entered into by the U. S. Department of Agriculture and the West Virginia College of Agriculture.

Handbook of social resources of the United States, G. P. HENDRICKS (*Washington: Amer. Red Cross, 1921, pp. LXXI+300*).—Compiled information on the health, nursing, social service, educational, recreational, and civic and community betterment resources of the country is presented in these pages. Mention is made of the general program of each organization, its specific

activities, field work, lecture and information service, reference and library facilities, survey and investigational activities, and publications.

The value of economic study in agricultural education and farm management, A. W. ASHBY (*Jour. Univ. Col. Wales, Agr. Dept.*, 10 (1921), pp. 3-13).—The author defines the two-fold aim of agricultural economics as that of supplying the principles of the management of farm businesses and the government of rural societies which are mainly dependent upon the condition of agriculture for their well-being. Certain economic problems that are constantly presented to farmers and landowners are suggested. Tables showing the total net output of six farms and yield per unit of land, capital, or labor are analyzed to illustrate the analysis of standards of production, the use of man and horse power, and the economy in animal husbandry as a field for close students of economic forces functioning in agriculture.

Prices of farm products in the United States, G. F. WARREN (*U. S. Dept. Agr. Bul.* 999 (1921), pp. 72, pl. 1, figs. 14).—Tabulated and graphically illustrated index numbers of wholesale prices of important agricultural products, monetary circulation, and purchasing power of farm products through a period of years, in some instances including the Civil War period and years following up to and including 1920, are presented as basic data for the interpretation of the situation as regards the present low prices of farm products and the breakdown in the farmers' purchasing power.

A general adjustment to a more stable price level is said to be important in correcting the situation. Other policies, such as the encouragement of exports of farm products by financing European purchases, a settled national attitude as a foundation for a self-sufficing farm economy, the orderly, conservative extension of credit to farmers, an increase in the numbers of live stock, the exportation of wheat and rye until Russia again becomes an exporting nation, and more attention to storing and financing crops on the farms in favorable years, are suggested.

Financing the farmer, J. B. MORMAN (*Mag. Wall St.*, 28 (1921), No. 8, pp. 521, 522, 576, 577).—The attitude throughout this discussion is that no general depression exists in the agricultural industry as a whole. Any distress existing is said to be confined to finding a market for the surplus of a few staple crops, such as wheat, cotton, wool, tobacco, and cattle, which national markets are not sufficient to absorb.

The present low prices of raw material are regarded as encouraging to manufacturing industries utilizing them, and the interdependence of farm and city populations in matters of production and consumption is expected to restore business equilibrium.

The author considers the amendment of July 1, 1921, to the Federal Farm Loan Act, providing additional Treasury credit to farm loan banks, a permanent provision affording ample farm mortgage credit to farmers on easy terms.

The road to better marketing, T. MACKLIN (*Wis. Agr. Col. Ext. Circ.* 136 (1921), pp. 16, figs. 4).—Successful commodity organization is said to be necessary as a prevention against flooding the local market. Efficient marketing outside of the local community requires consolidation, coordination, and cooperation. A plan of action embracing recommendations as to the marketing of pure-bred live stock, meat animals, cheese, butter, milk, potatoes, canning peas, wool, and sugar beets is briefly considered. Strong overhead sales organizations, adequate storage facility, as well as improved financing methods and more capital, are deemed imperative.

The Market Reporter (*U. S. Dept. Agr., Market Rptr.*, 4 (1921), Nos. 17, pp. 257-272, fig. 1; 18, pp. 273-288, fig. 1; 19, pp. 289-304, fig. 1; 20, pp. 305-320,

figs. 2).—The usual abstracts of information on domestic movement, imports and exports, prices, and the situation in the market of important classes of agricultural products and specified commodities are given in these numbers, together with analyses of foreign market conditions.

A rather extensive special study of the seasonal hog prices, graphically illustrated and accompanied by tabulations, is included in No. 17. A study of price data over a 20-year period is said to reveal four well-defined movements in hog prices. This discussion is confined largely to the second and third movements, which occur annually in the spring and fall and are seasonal in character.

Among special articles in No. 18 is one explaining the early shipments of this season's potato crop. No. 20 contains, among others, a special statistical article with tables reviewing celery shipments since 1916.

Monthly Crop Reporter (*U. S. Dept. Agr., Mo. Crop Rptr.*, 7 (1921), No. 10, pp. 121-132, *fig. 1*).—This number contains the United States crop summary for October 1, an incomplete world crop summary, as well as the usual estimated crop conditions with comparisons, tabulated index numbers of prices of agricultural products, and other information relating to crop conditions, estimated farm value of important products, range of prices on important markets, and average prices received by producers of the United States.

AGRICULTURAL EDUCATION.

The Nation and the schools, J. A. H. KEITH and W. C. BAGLEY (*New York: Macmillan Co.*, 1920, pp. XVII+364, *figs. 6*).—The first part of this book briefly outlines the historical development of the policy of Federal aid. One chapter traces in detail the history of the Morrill, Hatch and Adams, and Smith-Lever Acts, and other specific measures involving Federal grants for vocational education. Following this historical survey, the present situation is analyzed, and the deficiencies revealed by the war are traced to their causes. Measures before Congress at the time of writing are then considered, and the Smith-Towner bill is selected for detailed treatment, the remaining chapters being devoted to a study of its provisions and the educational conditions which they seek to improve. The rural schools of the United States and the policies and agencies for the preparation of teachers are given special emphasis. The book concludes with a discussion of the proposal to make an executive department for education with a cabinet officer at its head.

Sociological determination of objectives in education, D. SNEDDEN (*Philadelphia and London: J. B. Lippincott Co.*, 1921, pp. 322).—Questions are raised as to sources in the social sciences or in experience from which may be derived standards of examination for the "faith objectives" said to be controlling in certain educational fields. Some of these faiths are criticized as being practically superstitious, and certain new objectives are proposed for examination.

A chapter on the social objectives of vocational education sets forth some limitations on vocational education through schools, questions the democracy of our educational aims, and urges public support of all forms of vocational education to meet the needs of modern industrial trade conditions.

The project method of teaching, J. A. STEVENSON (*New York: Macmillan Co.*, 1921, pp. XVI+305, *figs. 2*).—The first seven chapters of this book deal with the theory of the project method. In chapter 8, projects which have been successfully worked out in elementary and high schools are outlined in order to show the application of this method of teaching.

Training disabled ex-service men at the Kansas State Agricultural College, R. L. CLUTE (*Kans. State Bd. Agr. Bien. Rpt.*, 22 (1919-20), pp. 232-239).—A number of courses taught by specialists on the college staff with the pur-

pose of helping prepare students for successful farm operation and management are noted. This report also explains briefly how the problem of providing profitable training to men who lack a working knowledge of common-school subjects, especially English and arithmetic, is being met. A number of farm problems studied and reported by the students are listed.

Boys' and girls' club work in Kansas since 1915, L. C. WILLIAMS (*Kans. State Bd. Agr. Bien. Rpt.*, 22 (1919-20), pp. 225-232, figs. 4).—The development of interest in this method of teaching and changes in the number and character of projects and clubs organized are reviewed here.

Health education in rural schools, J. M. ANDRESS (*Boston: Houghton Mifflin Co.*, 1919, pp. XII+321, pls. 15, figs. 41).—An attempt is made to treat the subject of health education from the rural teacher's point of view. This book aims to present reasons why health education is important; a discussion of the principles of pedagogy involved; subject matter on hygiene not usually available in the books accessible to teachers; references to the literature; drawings of hygienic devices which children may be taught to make; and carefully thought-out plans for training children in habits of personal hygiene and in improving the sanitation of schoolhouse and grounds, and suggesting the influence that the school may have upon rural communities in health matters.

Class exercises at the end of each chapter are designed primarily for students in normal schools and county training classes.

Study courses at our agricultural colleges, F. C. HARRISON (*Canad. Soc. Tech. Agr. Organizing Conv.*, 1920, pp. 33-40; trans. and abridged in *Sci. Agr.*, 1 (1921), No. 1, pp. 49, 50).—Certain recommendations are made regarding what the author deems the necessary entrance requirements and previous farm experience required for admission to Canadian agricultural colleges offering the bachelor and postgraduate degrees. As for the courses themselves, it is considered that they should fall into three main groups, comprising the basic sciences; the subjects of animal husbandry, agronomy, horticulture, poultry husbandry, agricultural engineering, apiculture, and a number of other practical subjects; and a cultural group, including English, pedagogy, and a foreign language.

Agricultural extension work in Canada, G. A. PUTNAM (*Canad. Soc. Tech. Agr. Organizing Conv.*, 1920, pp. 40-44; trans. in *Sci. Agr.*, 1 (1921), No. 1, pp. 45-47).—This article briefly sets forth the organization, the message, and the method of presentation of agricultural extension teaching from the Ontario Agricultural College.

[Agricultural education in St. Lucia in the nine months ended December 31, 1919] (*West Indies Imp. Dept. Agr., St. Lucia Agr. Dept. Rpt.*, 1919, pp. 20-32).—These pages incorporate reports by R. W. Niles on the progress of the teaching of agriculture in certain schools on the island and lectures and demonstrations given to teachers, as well as reports on cacao and limes prize holdings competitions intended to extend the cultivation of these crops and to give agricultural instruction to growers, as submitted by E. Buckmire and Niles.

The regional school of agriculture and vineyard practices at Rouffach (Haut-Rhin), GUERBER (*Rev. Vitic.*, 55 (1921), No. 1422, pp. 225-227, figs. 2).—This gives a brief account of the equipment of, and theoretical and practical courses offered at, a school in Alsace-Lorraine.

The higher normal institute of farm management, its purposes, its methods, LINDEMANS (*L'Institut Normal Supérieur d'Économie Ménagère Agricole, son But, ses Méthodes*. Liège, Belg.: Joseph Van In & Co., 1921, pp. 8).—These pages briefly describe the aim, the course of study, and the teaching methods at this new school at Laeken, Belgium.

NOTES.

Arizona University and Station.—The animal husbandry department has begun an experiment on the most profitable time to feed range stock for the market. Steer calves, yearlings, 2-year-old and 3-year-old steers, and old cows are being fed. Another phase of experiment has to do with the disposal of old cows on the range. The department is also conducting an experiment in the feeding of sunflower silage with cottonseed meal.

The station has resumed the publication of *Timely Hints for Farmers*, which was discontinued in 1918.

President R. B. von KleinSmid has been appointed head of the University of Southern California and has entered upon his new duties.

Colorado College.—*Science* notes that fire of unknown origin recently almost completely destroyed the chemical building, causing a loss on buildings and equipment estimated at \$70,000. The station laboratories were in the building.

L. A. Moorhouse, associate farm economist in the Office of Farm Management and Farm Economics, U. S. Department of Agriculture, has accepted an appointment as professor of economics and sociology.

Delaware Station.—Two laying houses, one 50 and the other 70 feet long, and a feed storage room have been added to the rehabilitation poultry plant. The poultry yards are also being fenced.

Idaho Station.—Harold W. Batchelor has been appointed assistant bacteriologist.

Purdue University.—W. F. Rue, assistant in poultry extension, has resigned and has been succeeded by F. W. Fitting.

Iowa College.—The construction of a new agricultural engineering laboratory has been authorized. This is to be a one-story structure of factory type, 180 by 220 feet, with an interior court. It is expected to house the department of agricultural engineering until an addition for classrooms, offices, etc., can be erected.

Kansas College and Station.—The four-year curriculum in agriculture has undergone a revision which will become effective at the opening of the college in the fall of 1922. The new curriculum involves an increase in the required work in agricultural economics, some condensation of subject matter in certain agricultural subjects, and a material increase in faculty counsel and supervision in connection with the student's selection of electives. It requires for graduation 133 semester credits, plus the required work in military science. Of the total credits required, 64 are in agricultural subjects. The prescribed work includes 43 semester credits in agriculture and 44 in nonagriculture, leaving a total of 46 credits to be secured through elective courses.

A feeding experiment is being conducted to supplement the agronomic and chemical data which are being secured from the Adams project on the effect of harvesting alfalfa at four different stages of growth. The harvesting is performed at the bud stage, the one-tenth bloom stage, the full-bloom stage, and the stage at which seed has been formed. The agronomic and chemical work on this project has been in progress for seven years. The feeding experiments were begun in the fall of 1919, when four lots of grade Hereford calves were

placed on test. Each lot contains five head and receives, during a period of 90 to 120 days each winter, no feed except alfalfa hay of one of the kinds produced by harvesting at the four different stages of growth above mentioned. All the cattle are kept together on native pasture during the grazing season. The same cattle are to be used for a period of three years, so that the feeding value of the different kinds of alfalfa hay will be determined for calves, yearlings, and 2-year-olds. The feeding work is supplemented each year by digestion trials, carried on with cattle of the same age and breeding as those used in the regular feeding test.

The department of entomology is making an investigation of the relationships between the physical characters of honeybees and the honey-gathering abilities of bee colonies. During the summer of 1920, 700 bees from each of four colonies and during the summer of 1921, 600 bees from each of six colonies were examined. The weight, length of tongue, and size of honey stomach of each bee were ascertained. The results so far secured indicate that there is a positive correlation between the size of the honey stomach and the quantity of honey gathered.

In connection with the investigations of roup, cholera, and fowl typhoid, the department of bacteriology has vaccinated 6,287 chickens during the past year to test the efficacy of a serum treatment which is being developed. Statistics collected by the department during the past seven years indicate that the mortality in untreated infected flocks may be expected to average about 15 per cent in the case of roup, 35 per cent in the case of cholera, and 30 per cent in the case of fowl typhoid. During the past year the mortality following vaccination in infected flocks was 0.62, 6.3, and 5.6 per cent, respectively.

A high-power wireless telephone plant is being installed for use by the extension division in circulating the daily market reports of the U. S. Department of Agriculture. It is planned to install receiving apparatus in each county agent's office as the official county receiving station, thus obviating the necessity of employing telegraph operators, as under the present system. Volunteer stations in a county are also contemplated. The plant at the college will include one of the largest radio outfits in the Middle West, with a daytime working range of the entire State, and a nighttime range of the entire country. Official college information along other lines may also be sent out in this way.

Matchless Dale, the well-known Shorthorn bull which for 10 years had been at the head of the college herd, died December 14, 1921, at the age of 15 years. The noted Hereford bull, Prince Rupert Twelfth, died the same day, aged 14 years.

Massachusetts Station.—The Massachusetts Fruit Growers' Association has adopted a nursery certification plan on the basis of the Adams Fund project of Dr. J. K. Shaw entitled Study of Tree Characters of Fruit Varieties. The indications are that one striking result of this project, first started in 1912 and organized as an Adams Fund project in 1917, will be to give American nurserymen a method whereby the varietal purity of trees in the nursery row may be established.

Dr. William P. Brooks, consulting agriculturist and formerly director of the station, retired from active service on November 20, 1921, under the provisions of the State retirement board.

Oliver L. Flint has been appointed specialist in charge of poultry disease elimination under the provisions of the State poultry disease elimination law, and Ray A. Carter collector of blood samples under the same law.

Carlos L. Beals has resigned as assistant research professor of plant and animal chemistry to enter research work in the preservation and manufacture of

milk by-products for a large milk-handling company. He is succeeded by John G. Archibald, of the Nova Scotia Agricultural College.

Dr. Paul J. Anderson, associate professor of botany, who until recently has given the major part of his time to his teaching duties in the department of botany, has been transferred as a full-time station employee as research professor for work along physiological lines.

Montana College and Station.—There has recently been a notable increase in facilities for the work in agricultural engineering. One of the barrack buildings erected during the war period has been remodeled and equipped for the department. This is a two-story building with two wings 44 by 84 feet, and a central portion 39 by 60 feet. The central portion will contain offices, storage rooms, etc. One of the wings is to be used for gas engines and farm machinery, and the other wing as an irrigation laboratory, wood shop, drafting room, and a classroom. Four assistants have been added to the department—J. R. Barker as assistant in irrigation in the college and station, R. M. Merrill as instructor in agricultural engineering, F. L. Griffin as instructor in drawing, and B. Ferguson as irrigation specialist in extension work.

H. M. Jennison, assistant professor of botany and bacteriology, has been granted leave of absence for the remainder of the college year for graduate study at the Missouri Botanical Garden and the Washington University.

New Hampshire Station.—A portion of the old creamery building was destroyed by fire in February, endangering the nutrition equipment housed therein. The respiration calorimeter, however, was not reached by the flames, and much of the equipment was salvaged. It is hoped to make temporary repairs and continue the work without serious interruption.

Rutgers College.—The initial step of consolidating the agricultural activities of the State University of New Jersey under a distinct College of Agriculture was taken December 16, 1921, when the five members of the agricultural committee of the board of trustees of the university and five representatives of the board of visitors met at New Brunswick and organized as the managing committee of the College of Agriculture.

Dr. J. G. Lipman, dean of the College of Agriculture, met the committee and outlined their functions. The step, he explained, is in line with the increasing field of service which the university is rendering to the agricultural interests of the State, and had the endorsement of both the board of trustees and the board of visitors. "All of the agricultural activities of both the college and experiment station," said Dr. Lipman, "are under the authority and immediate supervision of this managing committee. The acts of the committee, of course, are subject to the approval of the boards that they represent."

The enrollment in the College of Agriculture, including the four-year course, short courses, and graduate courses, is approaching 300, and a rapid growth is anticipated in succeeding years. To meet the increasing demands on the college for teaching, investigation, and extension service, the committee will at once undertake a definite plan for the development of an adequate plant.

The committee will hold regular monthly meetings.

Dr. Lipman is to attend the International Soil Congress to be held at Prague, April 18 to 25, as an American representative.

Cornell University.—Dr. E. C. Young, instructor in farm management, has been appointed assistant professor in farm management and rural economics at Purdue University.

Pennsylvania College and Station.—Dr. William Frear, associated with the college since 1885 and widely known as one of the pioneer agricultural chemists

of this country, died January 7 at the age of 62 years. Dr. Frear was a native of Pennsylvania, graduating from Bucknell University in 1881 and receiving the Ph. D. degree from Illinois Wesleyan University in 1884. He served as assistant in natural science in Bucknell from 1881 to 1883, and as assistant chemist in the U. S. Department of Agriculture from 1883 until his appointment in the Pennsylvania College as assistant professor of agricultural chemistry. He became professor of agricultural chemistry in 1886 and had been professor of experimental chemistry since 1907, as well as vice director and chemist of the station since 1887, and chemist of the State Board of Agriculture and the State Dairy and Food Bureau.

Dr. Frear had for many years been specially interested in questions pertaining to the analysis of foods, soils, fertilizers, the chemistry of tobacco, and food standards. He was a member of the U. S. Food Standards Committee from 1903 to 1907, and had represented the Association of Official Agricultural Chemists on the joint committee of the U. S. Department of Agriculture on definitions and standards since 1914, becoming its chairman in October, 1921. He had served as president of this association and vice president of the Association of American Agricultural Colleges and Experiment Stations, and was a fellow of the American Association for the Advancement of Science. He was also editor of *Agricultural Science* from 1892 to 1894.

Recent appointments in the college include Otto G. Schaefer as assistant professor of dairy husbandry extension, effective February 1; William H. Davis as assistant in dairy husbandry extension; and George F. Rupp as instructor in forestry.

Rhode Island College and Station.—A new agricultural and administration building has been dedicated. Myron G. Holmes has been appointed assistant chemist in the station.

Washington College and Station.—As a result of legislation passed by the last legislature, tuition is now being charged for the first time. The rates for residents of Washington and Alaska are lower than for others. Fees will also be charged for normal school extension courses, which have hitherto been free.

The Office of Farm Management and Farm Economics of the U. S. Department of Agriculture and the division of farm management in the station have just completed the field work in a business analysis and survey of a little more than 200 logged-off upland tracts. Cooperative relations have also been concluded between the State Department of Conservation and Development and the station for a study of methods of clearing land now in use. The work will be financed by the State Department of Conservation and Development and conducted by the station. It is believed the results of these two studies will be helpful in developing a logged-off land policy for the State.

Chelan County has made an appropriation sufficient to cover the entire expenses of the year's studies of orchard soils, cover crops, and fertilizers, conducted under the supervision of the station division of horticulture.

Extensive feeding tests of lambs and beef cattle are to be carried on at the irrigation substation at Prosser. About 360 tons of alfalfa hay and large quantities of corn silage were raised there this year. One thousand seven hundred lambs have been purchased for the first feeding trial. The Yakima Valley is a large hay-producing section and is rapidly developing into a district for winter feeding. The entire farm of 200 acres at this substation is now under irrigation and will be utilized for experimental work or the growing of commercial crops. Irrigation methods and duty of water studies on the standard crops of the field and orchard will be emphasized.

J. L. St. John, assistant chemist in the station, has been appointed acting chemist in charge of the division. Dr. J. R. Neller, formerly research assistant in the New Jersey Stations, has been appointed assistant chemist.

West Virginia University and Station.—Bert Holmes Hite, chief chemist of the station since 1895 and professor of agricultural chemistry in the university since 1898, died at Baltimore, Md., in October, 1921, at the age of 55 years. Professor Hite was a graduate of the university, receiving the M. S. degree in 1890, and subsequently studied for several years at Johns Hopkins University. He had been professor of organic chemistry from 1895 to 1898, chief chemist of the State Geological Survey since 1898, and vice director of the station for various periods.

Wisconsin University.—A memorial statue in honor of ex-Governor W. D. Hoard and located in a commanding position on the grounds of the College of Agriculture was dedicated February 3.

Miss Dorothy Roberts, a 1917 graduate and assistant professor of home economics, died December 12, 1921, as the result of burns received in an experiment using wood alcohol as fuel.

Wyoming University and Station.—A combined machine shed and tool shop is under construction at the university stock farm, and the contract has been awarded for a small greenhouse on the campus for experimental work.

S. H. Dadisman, assistant professor of agricultural education in the University of California, has been appointed associate professor of agricultural education.

Experiment Station Record.—George Haines, instructor in animal husbandry in Cornell University, succeeds F. J. Kelley as specialist in animal husbandry and dairying, beginning March 4.

Necrology.—G. Harold Powell, widely known as an authority on cooperative marketing, died February 18 at the age of 50 years. Mr. Powell was graduated from Cornell University in 1895, receiving the M. Agr. degree in 1896. For the next five years he was horticulturist and entomologist at the Delaware Station, and from 1901 to 1910 with the Bureau of Plant Industry of the U. S. Department of Agriculture as assistant pomologist, pomologist, and assistant chief. While with this Department he instituted important studies of the precooling of fruits and vegetables and of the causes of decay of citrus fruits in transit. In 1910 he became secretary-manager of the Citrus Protective League, and since 1912 had been general manager of the California Fruit Growers' Exchange. He was also in charge of the Division of Perishable Foods of the U. S. Food Administration during the war.

Mr. Powell was a delegate to the recent agricultural conference, delivering an address entitled Fundamentals of Cooperative Marketing, serving as chairman of the committee on marketing of farm products, and otherwise taking a prominent part in the proceedings of the conference. He was in great demand as a writer and lecturer on agricultural cooperation, and was the author of *Cooperation in Agriculture*, published in 1913, and numerous bulletins, addresses, etc.

Dr. Walter Van Fleet, horticulturist and physiologist of the Bureau of Plant Industry since 1910, died January 26 at Miami, Fla., aged 64 years. Dr. Van Fleet was educated as a physician, but after practicing for some time became horticultural editor for the *Rural New Yorker*, continuing in this capacity until entering the service of the U. S. Department of Agriculture. His work was primarily as a plant breeder, specializing on gladioli, chestnuts, and roses. He originated an unusual number of meritorious roses, including the climber bearing his own name, American Pillar, and Silver Moon, and had just been awarded three medals for his new rose, Miss Mary Wallace.

The death on March 1 is noted of another well-known plant specialist of this Department, Dr. William W. Tracy. Dr. Tracy was 77 years old and had retired from active service in April, 1921. He was a native of Ohio, but passed most of his boyhood in Vermont, and served during the Civil War with the Forty-fifth Massachusetts Infantry until invalided home in 1863. After a long period of convalescence he entered the Michigan Agricultural College, graduating in 1867, receiving the M. S. degree in 1870, and spending the next two years as professor of horticulture. For many years he was then connected with a seed concern of Detroit, Mich., as a practical plant breeder, entering the service of this Department in 1902 as superintendent of the testing gardens. He was the author of many articles dealing with varietal nomenclature, vegetable seed growing, and allied topics, including a treatise on Tomato Growing, published in 1907. He was given the honorary degree of D. Sc. by his Alma Mater at the celebration of its fiftieth anniversary in 1907.

Elbert S. Tucker, cotton entomologist of the Bureau of Entomology, U. S. Department of Agriculture since 1917, died December 10, 1921, aged 61 years. Mr. Tucker had previously held appointments for various periods in the University of Kansas, the Texas and the Louisiana Stations, and the Bureau of Entomology. He was the author of 118 papers on entomological subjects and a member of numerous entomological societies.

Julius Hann, the well-known Austrian meteorologist, died at Vienna, October 1, 1921. He was born at Schloss Hans, near Linz, Austria, March 23, 1839. Hann is perhaps best known for his long and efficient service in connection with the editorship of *Meteorologische Zeitschrift* and for his numerous and varied contributions to that journal. He was appointed to the staff of the Central Anstalt für Meteorologie at Vienna in 1868, being director of the service from 1874 to 1897. He was a voluminous author, collecting his material with the greatest pains and industry from all sources and all parts of the world. His contributions include many comprehensive treatises, such as his standard works, *Handbuch der Klimatologie* and *Lehrbuch der Meteorologie*, as well as numerous papers on various branches of the science of meteorology. He was especially interested in mountain observation and gave much attention to this phase of the study of meteorology. Among the more important of his recent papers were those dealing with the precise evaluation of mean daily temperatures, especially in tropical countries. It is reported that, in common with many other Austrian men of science, Hann suffered great privations, due to the distressing economic conditions prevailing in Austria following the war, but although his health suffered he maintained his industry and assiduity to the end.

○

EXPERIMENT STATION RECORD.

VOL. 46.

ABSTRACT NUMBER.

No. 3.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

Practicum of clinical chemical, microscopical, and bacteriological methods of analysis, M. KLOPSTOCK and A. KOWARSKY (*Praktikum der Klinischen Chemischen, Mikroskopischen, und Bakteriologischen Untersuchungsmethoden*. Berlin: Urban & Schwarzenberg, 1920, 6. ed., rev. and enl., pp. XV+518, pls. 24, figs. 40).—This is the sixth revised edition of this laboratory manual, originally written for the course in clinical chemistry, microscopy, and bacteriology at the Institute for Medical Diagnosis in Berlin. Methods are included for the bacteriological examination of secretions of the mouth, throat, nose, and eyes; bacteriological and microscopical examination of the sputum; chemical and microscopical examination of the stomach contents, feces, urine, and blood; microscopical and bacteriological examination of the spinal fluid and various exudates; and bacteriological examination in skin diseases, with a final chapter on general bacteriological methods.

Elementary chemical microscopy, É. M. CHAMOT (*New York: John Wiley & Sons, Inc.; London: Chapman & Hall, Ltd.*, 1921, 2. ed., rev. and enl., pp. XV+479, figs. 161).—This textbook on chemical microscopy "is intended to serve as an introduction to the microscope and its accessories as tools for the chemist." Comparatively few changes have been made in the second edition, but a brief synopsis of the course in introductory chemical microscopy as given at Cornell University has been inserted in the appendix.

A combined extractor, reflux condenser, still, and autoclave, A. T. SHOHL and M. L. KOCH (*Jour. Indus. and Engin. Chem.*, 13 (1921), No. 9, pp. 819, 820, figs. 6).—The apparatus described is a modification of an ordinary autoclave such as is used in sterilizing under pressure. The addition of a glass tube gauge shows the level of the contained liquid and permits the addition and removal of liquid through a charging funnel and a draw-off spigot. The autoclave is converted into a reflux or extraction apparatus by inserting an upright condenser in place of the usual blow-off valve. By changing the position of the condenser it may be converted into a condenser for a still. Descriptions with illustrations are given of the various parts of the apparatus and its use. The apparatus is said to be particularly satisfactory for the extraction of material either in the dry powder state or in the fresh moist state with different fat solvents or with water.

A simple laboratory gas meter and an improved Haldane gas analysis apparatus, H. S. NEWCOMER (*Jour. Biol. Chem.*, 47 (1921), No. 3, pp. 489-494, figs. 3).—This paper describes some improvements in apparatus to be used in connection with the Douglas method for the determination of the respiratory exchange. These include a gas meter adapted from the ordinary five-light gas service meter and an improved Haldane gas analysis apparatus.

Chemical structure and physiological action, C. L. ALSBERG (*Jour. Wash. Acad. Sci.*, 11 (1921), No. 14, pp. 321-341).—A presidential address delivered before the Washington Academy of Sciences January 20, 1921.

Treatise on pharmaceutical organic chemistry.—I, The aliphatic series. II, The aromatic series, M. DELACRE (*Traité de Chimie Pharmaceutique Organique. I, Série Grasse. II, Série Aromatique. Paris: Libr. Octave Doin, 1921, pts. 1, pp. X+198, figs. 12; 2, pp. X+187*).—In this reference book on pharmaceutical organic compounds the arrangement follows in general the sequence ordinarily used in the development of organic chemistry. The aliphatic and aromatic series are treated in separate sections, the order in both sections going from the simple hydrocarbons to their complex derivatives. The subject matter under each substance includes structural formulas, synonyms, preparation, properties, tests for identification, and uses. The discussion of the individual pharmaceutical compounds is prefaced by a general section on methods of separation, purification, and analysis of organic medicinal compounds, and throughout the book there is considerable discussion of the general chemical nature of the classes of compounds treated.

The vegetable oils, H. JUMELLE (*Les Huiles Végétales. Paris: Libr. J.-B. Baillière & Sons, 1921, pp. 496, figs. 125*).—This handbook on vegetable oils consists of chapters on the general, physical, and chemical characteristics of fats and oils; the oil industry, with descriptions and illustrations of machinery used in the various processes of extraction; and the various uses to which oils are put, including a separate chapter on the soap and candle industry. These are followed by chapters on the individual oils arranged according to the botanical classification of their sources, the subject matter including the botanical origin, geographical distribution, and methods of obtaining the oil, physical and chemical constants, general characteristics, and uses of the oil. Illustrations are given of most of the oil-bearing seeds described.

The odorous constituents of peaches, F. B. POWER and V. K. CHESNUT (*Jour. Amer. Chem. Soc.*, 43 (1921), No. 7, pp. 1725-1739).—The pulp of choice ripe peaches has been examined for its odorous constituents by methods similar to those employed in the previous study of the odorous constituents of apples (*E. S. R.*, 43, p. 711).

A special test of the pulp for hydrogen cyanid and benzaldehyde gave negative results, thus indicating that the glucosid amygdalin is restricted to the kernels of the fruit. Negative results were also obtained in testing for methyl anthranilate.

The odorous constituents were found to consist chiefly of the linalyl esters of formic, acetic, valeric, and caprylic acids, together with considerable acetaldehyde and a small amount of an aldehyde of higher molecular weight. The extraction of a concentrated distillate of the peach with ether yielded a small quantity (0.00074 per cent of the weight of the pulp) of a pale yellow limpid essential oil with a very fragrant and intense peach-like odor. On cooling below room temperature it formed a transparent solid, interspersed with minute, acicular crystals, consisting evidently of a paraffin hydrocarbon. The essential oil is exceedingly unstable, but if brought immediately into a glass tube and hermetically sealed is thought to be capable of preservation for an indefinite period.

The authors are of the opinion that the exact reproduction of the natural aroma of the fruit will be practically impossible, owing largely to the fact that "in the preparation of its esters linalool undergoes intramolecular changes with the formation of the isomeric compounds geraniol and terpineol or their respec-

tive esters, and as these esters have similar boiling points no means are available for their separation."

Theory and practice of cellulose hydrolysis, H. MAGNUS (*Theorie und Praxis der Strohaufschliessung*. Berlin: Paul Parey, 1919, pp. [4]+43).—This compendium of information on cellulose hydrolysis from the standpoint of preparation of cellulose concentrates is the outcome of the investigations conducted during the World War in the laboratory of the war committee on substitute feeding stuffs at Berlin.

The subject matter includes an historical and theoretical discussion of the possibilities of straw hydrolysis; an explanation of the action of sodium hydroxid on the various constituents of straw; descriptions of the technique of straw hydrolysis with sodium hydroxid, quick lime, and sodium carbonate; a discussion of the digestibility of lignin and crude fiber; and brief descriptions of the various methods in use for determining the extent of hydrolysis and the consequent value of the material as a concentrate. These include the determination of crude fiber by the methods of Weende and of Cross, the phloroglucin method, gravimetric determinations following hydrolysis with sodium hydroxid at boiling temperature and in the cold, and colorimetric methods.

Activated carbon, E. G. ARDAGH (*Jour. Soc. Chem. Indus.*, 40 (1921), No. 19, pp. 230T-233T).—A brief summary of recent papers on the activation of carbon.

Alkali fusions.—III, **Fusion of phenylglycin-o-carboxylic acid for the production of indigo**, M. PHILLIPS (*Jour. Indus. and Engin. Chem.*, 13 (1921), No. 9, pp. 759-762, figs. 5).—A continuation of the study previously noted (*E. S. R.*, 44, p. 310).

The diffusible calcium of the blood serum (*Jour. Biol. Chem.*, 47 (1921), No. 3, pp. 529-546, figs. 2).—Two papers are presented.

I. **A method for its determination**, L. von Meysenbug, A. M. Pappenheimer, T. F. Zucker, and M. F. Murray (pp. 529-539).—In this paper a technique is described for determining diffusible calcium in blood serum by dialyzing the serum against a buffer solution of the Ringer type while maintaining a constant CO₂ tension. The reaction is hastened by the addition of known amounts of calcium to the dialyzing fluid, a technique termed "compensation dialysis."

As determined by this method, the diffusible calcium of the serum of normal men and dogs was found to comprise from 60 to 70 per cent of the total serum calcium. This percentage was not altered by varying the CO₂ saturation of the serum between 17 and 62 mm. mercury tension.

II. **Human rickets and experimental dog tetany**, L. von Meysenbug and G. F. McCann (pp. 541-546).—The technique described in the first paper has been used to determine the diffusible calcium of the blood serum in human rickets and in experimental dog tetany, the work being undertaken principally with a view to determining whether in these pathological conditions there is an alteration in the proportion of diffusible and nondiffusible calcium.

In two cases of rickets with serum calcium of 9.0 and 7.6 mg. per 100 cc., the percentage of diffusible calcium was found to be between 58 and 70 per cent, figures within the range found in normal subjects. In four cases of experimental tetany in dogs similar percentages of dialyzable calcium were found, 58 to 71 per cent with serum calcium of 6.1 to 8.4 mg. per 100 cc. These results are thought to indicate that the reduced serum calcium in rickets and tetany is not due to a lowering of the diffusible as contrasted with the nondiffusible form.

A simple technique for the determination of calcium and magnesium in small amounts of serum, B. KRAMER and S. F. TISDALL (*Jour. Biol. Chem.*, 47 (1921), No. 3, pp. 475-481).—A simple and rapid technique for the quantita-

tive determination of calcium in 1 or 2 cc. of unashed serum and for the determination of magnesium in the supernatant fluid is described, and data are presented showing that the method is accurate to within ± 5 per cent of the amount of calcium and magnesium used.

The calcium determination consists essentially in precipitating the calcium with ammonium oxalate, centrifuging, dissolving the washed crystals of calcium oxalate in N sulphuric acid, and titrating with $N/100$ potassium permanganate. The magnesium determination involves precipitating the magnesium with ammonium hydrogen phosphate from the supernatant fluid of the calcium determination, filtering the precipitate (after standing over night) in a Gooch crucible, washing with ammonia and alcohol made alkaline with ammonia, drying in the oven at 80° C., dissolving in $N/100$ hydrochloric acid, treating the solution with standard ferric thiocyanate solution, and comparing the color with a series of standards of known NH_4MgPO_4 content. The preparation of reagents and technique of the method are described in detail.

Water-soluble vitamins and fermentation-accelerating compounds.—**I, Method for the determination and preparation of fermentation-accelerating substances from yeast and rice polishings,** S. FRÄNKEL and E. SCHWARZ (*Biochem. Ztschr.*, 112 (1920), No. 4-6, pp. 203-235, figs. 12).—The authors have used the fermentation of yeast as measured by carbon dioxide production to determine the activity of the various fractions obtained in attempts to isolate vitamin B from yeast and rice polishings. The technique of the fermentation tests consisted in adding the extract to be tested to a mixture of 5 cc. of a 10 per cent yeast suspension made from freshly pressed yeast cake and 10 cc. of a 10 per cent sucrose solution in a gasometer, placing this in the thermostat at 28° C., together with a control containing the same amount of yeast and sucrose and an amount of water equivalent to the extract, and after two hours measuring the volume of carbon dioxide evolved in both tubes. Using this method to test the various fractions, an attempt to isolate the active substance from yeast and rice polishings was made as follows:

Incompletely dried yeast was shaken with 80 per cent alcohol, the dissolved fat removed with ether, and the alcohol solution precipitated with basic lead acetate. The active filtrate was freed from lead with hydrogen sulphide and then precipitated with mercuric chloride. The precipitate was decomposed with hydrogen sulphide, freed from hydrochloric acid with lead and silver, and evaporated in vacuo. At this point crystals separated out which proved inactive while the remaining sirup was active. This was precipitated with picrolinic acid, the inactive picrolinate filtered off, the excess of picrolinic acid removed, and the solution precipitated with phosphotungstic acid. The active precipitate resulting was decomposed with barium acetate and mixed with 50 per cent sulphuric acid. The filtrate from this precipitation on evaporation in vacuo contained the active base as sulphate and proved to be 22 times as active as the original alcoholic extract. Attempts to set free the base by making the solution alkaline with sodium bicarbonate and shaking out with amyl alcohol were unsuccessful.

The composition of egg powder, F. F. BEACH, F. E. NEEDS, and E. RUSSELL (*Analyst*, 46 (1921), No. 544, pp. 279-283).—Tables are presented of the analysis of 3 samples of desiccated egg and 14 samples of so-called egg powder and substitutes. The data presented, which include moisture, ash, calcium sulphate, ether extract, nitrogen expressed as protein, organic phosphorus, and microscopical character, show that the egg powders, with the exception of one or two stated to contain actual egg, were merely colored baking powder. It is suggested that a quick method of determining the presence of actual

egg in such powders would be to extract the material with hot alcohol, saponify the alcoholic solution, and determine the total phosphorus.

The distribution of salts in milk, C. PORCHER and A. CHEVALLIER (*Compt. Rend. Acad. Sci. [Paris]*, 172 (1921), No. 25, pp. 1605-1607).—The authors have prepared a synthetic milk which, while admitted to be only an approximation, is considered to approach the real constitution of milk more closely than previous attempts. The distribution of the salts is as follows: Sodium chlorid 1.09, potassium chlorid 0.92, tricalcium citrate 1.78, trimagnesium citrate 0.76, tripotassium citrate 0.67, sodium bicarbonate 0.25, monopotassium phosphate 1.00, bipotassium phosphate 1.10, bicalcium phosphate 1.06, bimagnesium phosphate 0.16, potassium sulphate 0.18, and calcium caseinate 0.61 per cent.

A rapid acidity test for grading milk, R. H. SHAW (*Jour. Dairy Sci.*, 4 (1921), No. 2, pp. 91-94, fig. 1).—Previously noted from another source (E. S. R., 45, p. 507).

A method for determining adulterants in butter fat, G. SPITZER and W. F. EPPLE (*Indiana Sta. Bul.* 254 (1921), pp. 16, fig. 1).—The authors have devised a method for determining the adulteration of butter fat which, when referred to factory butter, ice cream, and condensed milk, is said to give results within 10 per cent of the total adulteration. Use is made of a triangular graph based upon representative Reichert-Meissl and saponification values of the three classes of fats as follows: Reichert-Meissl number 28.5 for butter fat, 1.5 for oleo oils, and 7 for coconut oils; saponification number 228.5, 196, and 259, respectively. An equilateral triangle is constructed, on the right side of which the range of Reichert-Meissl numbers from 1.5 at the lower to 28.5 at the upper apex is plotted in 54 equal spaces, each space thus representing a Reichert-Meissl value of 0.5. The base of the triangle is divided into 63 equal spaces covering the range from minimum to maximum saponification values, each space thus having a value of 1. A line is then drawn connecting the points representing the Reichert-Meissl and saponification values of butter (28.5 and 228.5) together with parallel lines for each whole number of the saponification value. Similarly a line is drawn connecting corresponding values for coconut oil (7 and 259) together with parallel lines for each 0.5 Reichert-Meissl value. The right side of the triangle then represents the oleo oil group, the left side butter fat, and the base coconut oil. The graph is completed by dividing each side into 20 equal spaces, each space corresponding to 5 per cent for the respective fats and through these points drawing lines parallel to the three sides, respectively.

To use the graph the Reichert-Meissl and saponification values of the sample are determined, and their point of intersection on the graph is located. Following this point to the left and parallel to the base gives the percentage of butter fat, downward and parallel to the oleo side the percentage of coconut oil, and upward and parallel to the butter fat side the percentage of oleo oil.

The publication contains the experimental data on the determination of the Reichert-Meissl, saponification, and Polenske values of a number of mixed fats of known composition, with corresponding results obtained on the graph, and an illustration of the graph developed as described.

The effect of atmospheric humidity on the determination of moisture in leather, F. P. VEITCH and T. D. JARRELL (*Jour. Amer. Leather Chem. Assoc.*, 16 (1921), No. 10, pp. 547-562).

A revision of the optical method for analyzing mixtures of sucrose and raffinose, C. A. BROWNE and C. A. GAMBLE (*Jour. Indus. and Engin. Chem.*, 13 (1921), No. 9, pp. 793-797).—The authors have revised the Croydt formula for analyzing mixtures of sucrose and raffinose to correspond with the change from 142.66 to 143 in the Herzfeld divisor of the Clerget formula for analyzing mix-

tures of sucrose and raffinose, and have also redetermined the inversion constant of raffinose and the temperature coefficient for the polarization of raffinose before and after inversion. The revised equations are as follows:

$$S = \frac{P(0.478 \times 0.0018t) - P'(1.006 - 0.0003T)}{(0.908 - 0.0032t) (1.006 - 0.0003T)},$$

$$R = \frac{P(0.43 - 0.005t) + P'(1.006 - 0.0003T)}{(1.681 - 0.0059t) (1.006 - 0.0003T)},$$

S and R equal the percentages of sucrose and raffinose, respectively, P and P' the direct and invert polarization readings, and T and t the temperatures of direct and invert polarization. The relative accuracy of this revised formula is illustrated in the case of known mixtures of sucrose and raffinose and in the case of known mixtures of these sugars with potassium oxalate and asparagin when lead subacetate is used as a clarifying agent. The influence of optically inactive salts, optically active amino compounds, and clarifying agents on the accuracy of the method are discussed.

Preliminary studies on some fungi and bacteria responsible for the deterioration of South African sugars. P. A. VAN DER BIJL (*Union So. Africa Dept. Agr., Sci. Bul. 12 (1920), pp. 32, figs. 16*).—This report deals chiefly with four varieties of fungi and three of bacteria isolated from samples of so-called sweating sugars. The fungi included *Aspergillus*, *Stemphylium*, *Sterigmato-cystis*, and *Hormodendron cladosporoides*. Studies of the effect of concentration, temperature, and various disinfectants on these fungi in sugar solution showed that, with the exception of *Stemphylium*, all are capable of growing in solutions of 63° Brix, the highest concentration tested. Immersion in boiling water for 15 minutes of tubes containing solutions inoculated with the fungi was sufficient to destroy them. The addition to 50 cc. of mill juice of 0.27 gm. of sodium chlorid or 0.5 gm. of ammonium fluorid, 4 cc. of 5 per cent sodium bisulphite solution, 12 cc. of 0.5 per cent commercial formalin, and 6 cc. of 2 per cent chlorid of lime solution containing 16 per cent of available chlorin, or milk of lime containing 5 per cent of calcium oxid, sufficed to inhibit the growth of all four organisms.

The three forms of bacteria isolated from the sugar belonged to the potato group of bacilli characterized by the high resistance of the spores to heat, their capability of forming gum in the fermentation of sugars, and their low nutritive requirements. The spores of these bacteria were quite resistant to heat, surviving a temperature of 100° C. for two hours or more. They were not destroyed by 30 minutes' exposure to 1:50 formalin or 1 per cent sodium fluorid.

As the periods during which most of the sweating and deterioration took place were those in which the relative humidity and temperature were highest, the advisability is suggested of constructing storehouses with double walls so as to allow the circulation of air and at the same time prevent the admittance of moist air. As a means of preventing infection of the sugars, it is suggested that milk of lime be used for disinfecting the walls and ceilings of storehouses and chlorid of lime for disinfecting filter bags and the tanks containing the fermented juices.

Preliminary studies on some fungi and bacteria responsible for the deterioration of South African sugars. P. A. VAN DER BIJL (*Internat. Sugar Jour., 23 (1921), No. 270, pp. 320-324, figs. 4*).—A summary of the above paper.

Equipment for making sorghum sirup. M. W. HENSEL (*N. C. Agr. Col. Ext. Circ. 117 (1921), pp. 20, figs. 10*).—This circular gives brief descriptions of the

machinery and utensils necessary for the manufacture of sorghum sirup in a small factory for the supply of the individual farm home or on a larger scale for a community factory.

A process of producing palatable sirup from sugar beets, S. F. SHERWOOD (*Jour. Indus. and Engin. Chem.*, 13 (1921), No. 9, pp. 799-801).—The process described, which was developed at the Bureau of Plant Industry, U. S. Department of Agriculture, as a modification of the method of Townsend and Gore (*E. S. R.*, 37, p. 511) consists essentially in extracting the juice from thin slices of washed and trimmed beets by heating at 80° C. for an hour in sufficient water to prevent access of air, straining the extract to remove suspended material, heating it in an autoclave or pressure cooker at from 108 to 110° for one hour, during which time steam is blown off at 15-minute intervals, straining the extract again, and finally evaporating it to a sirup. Successful results have also been obtained by heating to 110 or 112° for one hour with constant blowing-off of steam. The objectionable odor and flavor of ordinary beet sirup are said to be eliminated by this process, the resulting product being very palatable, although possessing a flavor quite different from other sirups.

In the experimental work reported, the yield from 100 lbs. of beets averaged slightly over 2 qt. of sirup for a single extraction and 1 qt. for a second. With beets at \$7 per ton the cost of the material would thus amount to only 35 cts. for a yield of 3 qt. The method is thought to be admirably suited to the preparation of beet sirup in homes provided with ordinary pressure cookers.

An improved method of making sugar-beet sirup, C. O. TOWNSEND and S. F. SHERWOOD (*U. S. Dept. Agr., Farmers' Bul. 1241* (1921), pp. 16, figs. 9).—In this publication, which supersedes Farmers' Bulletin 823 (*E. S. R.*, 37, p. 511), the process for making the sirup has been revised to include the modifications described in the above paper.

[**Pectin studies**] (*[Gt. Brit.] Dept. Sci. and Indus. Research, Food Invest. Bd. Rpt. 1920*, pp. 22, 24).—In the progress report for 1920 of the fruit and vegetable committee of the Food Investigation Board, Great Britain, it is noted that the juice of apples kept in cold storage or in carbon dioxide storage contains markedly less pectin than the juice of apples in ordinary storage; also that unripe gooseberries after standing in open vessels for some days show a considerable increase in pectin content compared with ungathered fruit, but that the normal increase in pectin is lessened by mincing the tissue and covering with water, by coating the berries with vaseline, or by storage in an air-tight vessel. Evidence is presented that more pectin can be obtained from fruit tissue by the action of heat and acid than is originally present in the soluble state. In quantitative estimation of the amounts of soluble pectin obtained from fresh and dried apple tissue by successive extractions with cold water, hot water, or steam under pressure, and hot dilute acid, it was found that the amount of pectin obtained by the action of steam under pressure was considerably greater than that obtained by heating with water, and almost as much as that obtained by the action of hot acid.

The occurrence of methyl anthranilate in grape juice, F. B. POWER and V. K. CHESNUT (*Jour. Amer. Chem. Soc.*, 43 (1921), No. 7, pp. 1741, 1742).—In this note from the Bureau of Chemistry, U. S. Department of Agriculture, the authors report that methyl anthranilate has been found to be a natural and apparently constant constituent of grape juice, although the amounts occurring in different varieties of grapes appear to vary greatly.

Cider and its preservation, F. E. RICE and A. L. MARKLEY (*N. Y. Agr. Col. (Cornell) Ext. Bul. 44* (1921), pp. 23, figs. 2).—This publication discusses the chemical composition and food value of apple cider, and the most practical methods for its preparation, clarification, preservation, and concentration.

The New York State legal requirements for the handling and sale of cider are included.

Home canning of fruits and vegetables (*U. S. Dept. Agr., Farmers' Bul. 1211* (1921), pp. 51, figs. 15).—In this publication, which is intended to replace Farmers' Bulletins 839 and 853 (E. S. R., 38, p. 12), considerable attention is paid to the reasons for each step in the various canning processes.

Making the olive palatable, W. V. CRUESS (*Amer. Food Jour.*, 16 (1921), No. 10, pp. 7-10, figs. 3).—This is a general discussion of the modern process of pickling ripe olives.

Drying crude drugs, G. A. RUSSELL (*U. S. Dept. Agr., Farmers' Bul. 1231* (1921), pp. 16, figs. 6).—The fundamental principles of drying are discussed with particular reference to conditions essential for obtaining good results with drug materials, and descriptions are given of a small stove drier and a large type drier suitable for drying as much as several pounds of green crude drugs per day. General directions are included for the management of the dry house and for the care of the dried crude drugs.

A fermentation process for the production of acetone, alcohol, and volatile acids from corncobs, W. H. PETERSON, E. B. FRED, and J. H. VERHULST (*Jour. Indus. and Engin. Chem.*, 13 (1921), No. 9, pp. 757-759).—This paper reports the results obtained at the Wisconsin Experiment Station on the fermentation of corncob sirup or molasses by means of *Bacillus acetoethylicum*. The products of fermentation and conditions influencing these products have been previously noted (E. S. R., 44, p 710).

The sirup was prepared by heating the cobs for one hour at a pressure of 20 lbs. with about 8 per cent of their weight of sulphuric acid, a process similar to the one employed by Fred and Peterson in fermentation studies of corncob sirup with the pentose-forming organism *Lactobacillus pentoaceticus* (E. S. R., 45, p. 510).

The best results were obtained by conducting the fermentation in a container partly filled with cinders to which the bacteria cling, thus bringing about a good distribution of the organism. An important condition to be observed is the reaction of the medium, which should be at between pH=7.6 and 8.4 at the beginning of the fermentation. An abundance of calcium carbonate should be present to neutralize the acids formed. Under optimum conditions the yield from 100 lbs. of corncobs was 2.7 lbs. of acetone, 6.8 lbs. of alcohol, and 3.4 lbs. of volatile acids.

METEOROLOGY.

Agricultural meteorology (*Inst. Internatl. Agr. [Rome], Actes 5. Assemblée Gén., 1920, II, pp. 466-540*).—This, the third report on the subject to the International Institute of Agriculture at Rome, reviews the progress in agricultural meteorology in different countries, with extensive bibliographies of literature on the subject, and gives an account of the efforts made under the auspices of the institute to promote international organization of agricultural meteorology. Detailed accounts are given of the organization of agricultural meteorological services in France (by Louis-Dop) and Sweden (by A. Wallén), with shorter references to the organization of such work in the United States, Russia, Italy, Great Britain, and Ecuador. It is reported that the proposed organization of an international society of geography and agricultural meteorology has been accepted by Italy, France, Denmark, Sweden, Norway, Belgium, Portugal, Switzerland, Greece, Brazil, and China.

Studies of the frost problem, I, II, A. ÅNGSTRÖM (*Geografiska Ann., Nos. 1* (1920), pp. 20-32; 3 (1921), pp. 278-290, figs. 2).—This is an attempt to elucidate the physical laws on which rules for frost warnings may be based.

Drought periods and climatic cycles, F. E. CLEMENTS (*Ecology*, 2 (1921), No. 3, pp. 181-188).—Analyses of the rainfall at over 1,300 stations in 23 western States, extending from Indiana to the Pacific coast, show that "a critical drought period has occurred in the West since 1858, and perhaps since 1835, at each sun-spot maximum for which the spot number was greater than half the number known for the year maximum. This does not mean that drought years have not occurred at other times, but a preliminary examination of the records for the years centering about the sun-spot minima shows no general and critical drought throughout the West at such times. The periods of the minimum are now being analyzed with reference to this point, as also to the relation of the sun-spot minimum to increased or excessive rainfall."

Climatological data for the United States by sections (*U. S. Dept. Agr., Weather Bur. Climat. Data*, 8 (1921), Nos. 7, pp. [187], pls. 3, fig. 1; 8, pp. [187], pls. 3, fig. 1).—These numbers contain brief summaries and detailed tabular statements of climatological data for each State for July and August, 1921, respectively.

Meteorological observations at the Massachusetts Agricultural Experiment Station, J. E. OSTRANDER and G. E. LINDSKOG (*Massachusetts Sta. Met. Buls.* 393-394 (1921), pp. 4 each).—Summaries of observations at Amherst, Mass., on pressure, temperature, humidity, precipitation, wind, sunshine, cloudiness, and casual phenomena during September and October, 1921, are presented. The data are briefly discussed in general notes on the weather of each month.

Meteorology [of New South Wales], H. A. SMITH (*N. S. Wales Statist. Register*, 1919-20, pt. 7, pp. 353-398).—Observations on pressure, temperature, rainfall, and other meteorological phenomena at Sydney during 1920 and other places during 1919, as compared with similar observations in previous years, are tabulated in detail.

Summarizing the general meteorological conditions for the country as a whole, it is stated that "the outstanding feature of 1919 was drought or a deficient rainfall over a large portion of the State. The few falls which did occur were confined mostly to the eastern areas, and were so scanty in distribution as to be of little benefit."

SOILS—FERTILIZERS.

The rôle of osmotic pressure in the toxicity of soluble salts, J. E. GREAVES and Y. LUND (*Soil Sci.*, 12 (1921), No. 2, pp. 163-181, figs. 12).—In a contribution from the Utah Experiment Station, experiments are reported in which osmotic pressure was determined by the cryoscopic and electrical conductivity methods on soil to which the chlorids, sulphates, carbonates, and nitrates of potassium, sodium, calcium, magnesium, iron, and manganese had been added in quantities such that (1) the salts became toxic to the ammonifying organism, (2) the quantity of ammonia produced in unit time was reduced to three-fourths normal, (3) the concentration of the salt in the soil was 10×10^{-3} M per 100 gm. of soil, (4) the salt became toxic to the nitrifying organism, (5) the nitric nitrogen produced in unit time was reduced to three-fourths normal, and (6) there was 2×10^{-3} M of the salt in each 100 gm. of the soil.

With the exception of manganese nitrate, iron nitrate, and sodium carbonate a close correlation was found between toxicity and osmotic pressure. All the salts tested except these three became toxic when the osmotic pressure was less than 3 atmospheres. As the concentration of the salts added to the soil increased, it was evident that the retarding effect upon the ammonifying organism was not due entirely to the osmotic pressure. It is considered probable that there is a physiological action of the substance upon the living protoplasm

which changes its physical and chemical properties so that it can not function normally.

All salts tested reduced ammonification to less than one-half normal when the osmotic pressure of the soil reached 15 atmospheres, yet there were appreciable quantities of ammonia produced in the presence of some salts when the osmotic pressure reached 20 atmospheres. With the exception of sodium chlorid, manganese nitrate, and iron chlorid, all the salts tested became toxic to nitrifying organisms when the osmotic pressure ranged between 1 and 2 atmospheres.

The nitrifying organisms behaved in a manner similar to the ammonifying organisms, except that they were retarded at much lower osmotic pressures. All the salts reduced nitrification to less than 50 per cent when the osmotic pressure reached 6 atmospheres.

Lysimeter experiments.—II, Records for tanks 13 to 16 during the years 1913 to 1917, inclusive, T. L. LYON and J. A. BIZZELL (*New York Cornell Sta. Mem. 41 (1921), pp. 51-93*).—In a second contribution to the subject (E. S. R., 39, p. 517), experiments are reported, the object of which was to observe the removal by drainage water and by crops of calcium and certain other soil constituents from Volusia silt loam. This soil is a rather unproductive type, widely distributed over the hills of southern New York, and in chemical composition is distinguished by its low content of calcium. The experiments covered a period of five years.

The average annual rainfall for the period was 32.97 in., of which 82.3 per cent percolated through the unplanted soil and 62.5 per cent through the cropped soil. About 40 per cent of the rainfall passed into the air from the surface of the soil and through the plants growing on it. Applications of burnt lime had no appreciable effect on the proportion of rainfall that percolated through the soil. It is thought that liming of this soil would probably not facilitate the removal of water through tile drains.

The average evapo-transpiration ratio for the cropped soils was 1:908, the crops being maize, field peas, oats, and barley. The average minimum transpiration ratio for the same crops was 1:451. Both of these ratios were much wider for the Volusia soil than for the Dunkirk soil in the experiments of the previous report. In this comparison the soil having the greater production of dry matter in crops per unit of water used was the one that had the greater concentration of total solids in the drainage water.

The application of lime apparently favored the production of nitrates in the Volusia soil, but it had no such effect on the Dunkirk soil. The lime requirement of the Dunkirk soil, as determined by the Veitch method, was very little less than that of the Volusia soil. The amount of nitrogen in the maize, allowing for that in the roots, added to that in the drainage water from the same tanks was greater than the amount in the drainage water from the corresponding bare tanks. In the case of oats the amount of nitrogen in the crop and in the drainage water was less than in the drainage water from bare soil.

The amount of calcium in the drainage water of the unplanted soil was greater than that in the crops and the drainage water combined from the cropped soil. This is taken to indicate that the process of cropping conserves the calcium in the soil even when the crops are removed. Apparently the application of burnt lime to the Volusia soil increased the amount of soluble calcium therein.

Magnesium was present in the drainage water in a much smaller quantity than was calcium. Application of lime to the soil increased the quantity of magnesium in the drainage water, while cropping decreased it.

Potassium was removed in a larger quantity in the drainage water than in the crops. The application of lime did not increase the amount of potassium

removed in the drainage water or by the crops. Cropping did not materially affect the total removal of sulphur from the soil. Applications of lime slightly decreased the amount of sulphur removed in the drainage water. The amounts of phosphorus removed in the drainage water were too small to be determined. Applications of lime increased the removal of phosphorus in the crops.

A comparison of soil temperatures in upland and bottomland forests, W. B. McDUGALL (*Ill. State Acad. Sci. Trans.*, 13 (1920), pp. 249–254, figs. 2).—In a contribution from the University of Illinois, the results of a series of measurements of soil temperatures undertaken to compare conditions of habitat in upland and bottom land forest soils are reported.

It was found that the soil in the bottom-land forest is constantly colder than that in the upland forest, the average difference at a depth of 3 in. being 2.4° F. and at 12 in. 2.5°. The greatest difference found at the 3-in. depth was 3.5° on June 24, and at the 12-in. depth 4.3° on July 6. The smallest difference recorded at 3 in. was 1.5° on July 12 and at 12 in., 1.2° on August 27.

There was even a greater difference in air temperatures than in soil temperatures in upland and lowland forests, the average difference between three readings taken being 4.1°.

The effect of organic matter on soil reaction, II, R. E. STEPHENSON (*Soil Sci.*, 12 (1921), No. 2, pp. 145–162, fig. 1).—In a second contribution to the subject from the Iowa Experiment Station (E. S. R., 41, p. 319), the organic materials used were soy bean hay, green rape, oats straw, green soy bean hay, dried blood, and a mixture of blood and oats straw. The experiments were conducted in both limed and unlimed soils. The green materials were dried and ground as finely as possible before adding to the soil. The soil used was an acid silt loam, rather heavy and compact and deficient in organic matter.

It was found that oats straw again reduced nitrification and ammonification below that of the untreated soil. A mixture of straw and blood reduced the total nitrogen found in the form of ammonia and nitrates below that of the blood treatment alone. Ten tons of straw with the blood caused a somewhat greater reduction than the 5-ton application. All the treatments reduced the lime requirements indicated by the Tacke method until nitrification had taken place. Lime-requirement determinations of the limed soils showed that the treated soils were always capable of reaction with more lime, although an excess of 2 tons of limestone had been applied. This is taken to indicate that the soils contain acids which are very slowly reactive, and will perhaps react with limestone beyond their neutral point.

The residual carbonates where blood was applied were completely exhausted at the last sampling. The hydrogen-ion determinations showed that in practically every case the organic treatments reduced the true acidity. In some cases, on the contrary, both lime and organic treatments did not give as alkaline a soil as did the lime alone. Changes in soil reaction, especially on the blood-treated soils, followed very closely the deficit or excess of ammonia over nitric nitrogen, indicating that these processes may become factors influencing the production of acid soils.

Further studies on buffering in soils, the nature of soil acidity, source of organic and mineral acids, and the loss of bases by soils showed that highly organic soils and clays exhibit a high degree of buffering, while coarse sands show little of this capacity. Sulphuric acid or physiologically acid salts such as ammonium sulphate were found to cause a change toward increased hydrogen-ion concentration in soils. Citric acid did not increase the true acidity.

Ammonium sulphate caused a greater increase in acidity than did its nitrogen equivalent of albumin. When nitric and sulphuric acids were added to the soils in amounts equivalent to the acidity which might be produced from the

complete nitrification of ammonium sulphate, a greater increase was produced in the hydrogen-ion concentration of the soil than where the ammonium sulphate was used. A large excess of pure calcium carbonate (20 tons per acre) brought the pH value to only a little more than 8, which seemed to be about the limit of alkalinity produced by limestone.

Decomposition of green manures at different stages of growth, T. L. MARTIN (*New York Cornell Sta. Bul. 406 (1921), pp. 139-169, figs. 10*).—Studies to determine the exact stage of growth at which crops used as green manures decompose most rapidly and exert their greatest influence on the soil, as indicated by rate of humus formation, accumulation of nitrates, and increased availability of plant nutrients in soil, are reported. The soil used was Dunkirk clayey silt loam. Rye, oats, and buckwheat were used as green manures, each crop being obtained at three different stages of growth.

The study consisted of a series of three experiments covering the period of three years. In the first series equal green weights of rye, oats, and buckwheat were incorporated at three stages of maturity with separate samples of soil and incubated for 12 months. In the second series equal dry weights of the same crops were added to separate soil samples and incubated for four months. In the third series nine areas of soil were sown to rye, oats, and buckwheat, three areas being given to each crop. Green material, representing the first, second, and third stages of maturity for each crop was then successively obtained from the respective areas for incorporation with the soil to be studied. With increase in maturity there was a corresponding increase in the green and dry weights added to the soil, thus approximating field conditions.

It was found that the value of organic matter in the soil is dependent on the ease with which it decays. The greater the succulency of the crops used as green manures the more quickly do they decay. When crops are about half grown they are said to be at the point of maximum succulency. Soils receiving incorporations of green manure at the half-mature stage produced the largest crop yields when subsequently cropped.

Increasing amounts of dry matter added to the soil in conjunction with increased maturity had the same general effect on the humus formation, the accumulation of nitrates, and crop growth as did the addition of equal weights at each stage of increased maturity. The more rapid the decomposition of green manures the greater was the increase in the availability of plant nutrients in the soil, as indicated by the greater crop yields. The younger the organic matter used the larger was the percentage of total nitrogen present therein.

The rate of nitrate accumulation was the greatest when green manures of maximum succulency were incorporated with the soil. It is thought that some of the nitrates formed in the soil by the influence of green manure are probably utilized by growing organisms. It was found that nitrates do not accumulate in the soil until the green manures have become considerably decomposed. The longer the period during which green manures were allowed to humify in the soil the less was the amount of humus found in the soil on analysis.

There are considered to be three periods in the humification of organic matter. In the first period humus alone is formed, thus allowing an accumulation in the soil. During the second period humic decomposition sets in and the humus is reduced as rapidly as it is formed, resulting in no further accumulation. In the third period humus formation ceases and the only process is humus decomposition, resulting in a rapid decrease in the amount in the soil.

Under the same conditions rye and oats were found to decay at approximately the same rate. Buckwheat, particularly in the maturer stages, decayed much more readily than rye or oats of corresponding maturity.

It is concluded that the greatest rapidity of decomposition and the greatest benefit to the soil are achieved by the use of these green manures at the half grown stage.

Organic matter for the soil (*Rhode Island Sta. Rpt. 1920, pp. 5, 6*).—The progress results of studies on the use of green manures, stable manure, and peat as organic matter for the soil are presented (E. S. R., 44, p. 22).

Reconnaissance soil survey of the central southern area, Calif., J. E. DUNN ET AL. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1917, pp. 136, pls. 5, fig. 1, maps 2*).—This survey, made in cooperation with the California Experiment Station, deals with the soils of an area of 4,691,200 acres in southern California, which includes nearly all of Orange County, the southern two-thirds of Los Angeles County, the southwestern part of San Bernardino County, and the western part of Riverside County. It embraces mountain, desert, and valley regions. The mountain region covers about one-half of the area. The desert region embraces a part of the Mohave Desert in the north-eastern and a part of the Coachella Desert in the southeastern parts of the survey. The valley region embraces the Great Valley of southern California.

The drainage of the region embraced within the survey is mainly to the Pacific Ocean, through the Santa Clara, Los Angeles, San Gabriel, Santa Ana, and San Jacinto Rivers. North of the summits of the San Gabriel and San Bernardino Mountains and east of the summits of the latter named range and the San Jacinto group, the drainage is into the desert regions. The drainage from the northern slope is mainly carried by the Mohave River. White-water River and Mission and Morongo Creeks are the principal streams draining into the Coachella Desert. Most of the area is well drained and free from alkali, but localities of poorly developed drainage and alkali accumulation occur. The larger of these are in the low flat parts of the delta plain of the larger streams near the coast. Smaller areas occur near Chino, Ontario, Arlington, San Bernardino, in the valleys in the southern part of the survey, and in the Mohave Desert.

The survey indicates the existence of a large number of soil types and series in the area which vary in topography, origin, and mode of formation. They are grouped as residual soils, soils derived from Coastal Plain and old-valley-filling material, recent alluvial soils, soils derived from wind-laid material, and miscellaneous materials mainly nonagricultural. Including tidal marsh, riverwash, coastal beach and dunesand, and rough broken and stony land, 47 soil types of 23 series are mapped, of which the rough broken and stony land covers 49.7 per cent of the area.

Parts of the area have been previously covered by detailed surveys (E. S. R., 38, pp. 215, 421, 621; 41, pp. 127, 511).

[**The soils of central Florida**], R. M. HARPER (*Fla. Geol. Survey Ann. Rpt., 13 (1920), pp. 170-194*).—In this portion of this report the principal types of soil of central Florida are classified roughly by water content, color, etc., and mechanical and chemical analyses of prevailing types are presented and discussed.

It is stated that the soils of the region, although prevailing sandy, are considerably diversified within certain limits. Alluvial and red clay soils are scarce, but soils are found ranging in chemical composition from nearly pure calcium carbonate and those high in phosphate content to nearly pure silica and peat.

The mechanical analyses indicate that the low clayey hammocks of the Gulf hammock and lake regions contain the largest proportion of silt and clay, the former containing over 50 per cent and the latter over 25 per cent in the soil

and 65 per cent in the subsoil. The white sand or scrub of the lake region and east coast contains the least clay and is the poorest soil listed.

The chemical analyses indicate that as a whole the soils of central Florida generally contain less potash than those of northern Florida or of any equal area a few hundred miles farther inland. The scrub and dune soils are low in potash. Lime like potash is as a rule most abundant in the richest soil, and vice versa.

Soil survey of Winnebago County, Iowa, W. E. THARP and G. H. ARTIS (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1918, pp. 31, fig. 1, map 1*).—This survey, made in cooperation with the Iowa Experiment Station, deals with the soils of an area of 255,360 acres lying wholly within the Wisconsin drift area in northern Iowa. The topography ranges from very gently undulating to rolling with limited areas to the east where morainic ridges and knobs are common features. In the central and eastern townships there is said to be much land that originally required artificial drainage. Nearly all of this has been reclaimed.

Glacial deposits form the surface of the entire county and are the parent materials of all the soils. Including muck, peat, and meadow, 8 soil types of 5 series are mapped, of which the Clarion loam, including a rolling and a steep phase, and the Webster clay loam cover 73.2 and 10.7 per cent of the area, respectively.

Soil survey of Reynolds County, Missouri, H. H. KRUSEKOPF ET AL. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1918, pp. 30, pls. 3, fig. 1, map 1*).—This survey, made in cooperation with the Missouri Experiment Station, deals with the soils of an area of 502,400 acres which lies in the Missouri Ozark region in southeastern Missouri. In general the surface of the county is rough and hilly, being characterized by sharp ridges, steep slopes, and narrow valleys. The greater part of the county is drained by Black River, and the run-off is said to be rapid.

The soils of the county are similar to those of the central Ozark region, and are characterized by their gray color and high content of chert fragments. The upland soils are of residual origin, and the bottomland soils consist of alluvial and colluvial materials. Including rough stony land and riverwash, 14 soil types of 7 series are mapped, of which the Clarksville stony loam, rough stony land, and Clarksville gravelly loam cover 47.4, 14.7, and 14.3 per cent of the area, respectively.

Preliminary report on the management of Willamette Valley soils (*Oregon Sta. Bul. 185 (1921), pp. 3-12, fig. 1*).—This is a progress report of work conducted partly in cooperation with the Bureau of Soils of the U. S. Department of Agriculture. It is stated that about 50 per cent of the soils of the Willamette Valley have been surveyed, and chemical analyses of each soil type in Yamhill, Washington, and Multnomah Counties, including 101 samples and 920 determinations, are presented.

Field and greenhouse experiments to determine the fertility requirements and crop adaptations of the more important soil types of the valley are also presented. The soils of the valley are grouped as residual, old valley filling, and recent river and stream bottom soils. So far 27 soil series have been established. The analyses indicate that with comparatively few exceptions the surface soils are well supplied with nitrogen in the form of organic matter. All of the heavier soils are said to be well supplied with potassium. The indications are that phosphate fertilizers will give good returns on the hill soils and on valley soils that have been heavily cropped to grain.

Drainage is considered to be the first step in the reclamation of one-third of the land in the valley floor, and it is thought that proper supplemental

irrigation will pay on the naturally drained free working soils of the stream bottoms where water is readily available and applied to late-season and intensive crops.

The general use of farm manure has been found to be profitable on the soils of the valley, and on soils deficient in sulphur, gypsum has been found to be profitable when used as a top-dressing on clover and alfalfa. Profits from liming are said to be more certain on the red hill soils and worn grain lands in the more humid sections, and on the heavily tilled soils previous to seeding down clover. The indications are that potassium is not likely to prove profitable except on deep peat soils.

The management of several types of western Washington soils, M. E. McCOLLAM (*Washington Sta., West. Wash. Sta. Bimo. Bul.*, 9 (1921), No. 5, pp. 67-71).—Brief popular information is given on the management of gravelly sandy loam soils of the Everett and Spanaway series and of muck and peat soils.

Agricultural soils in the vicinity of Perugia [Italy], P. PRINCIPI (*Staz. Sper. Agr. Ital.*, 53 (1920), No. 10-11, pp. 334-392).—Physical, chemical, and geological studies of the soils of Perugia and vicinity in Italy are reported.

The agricultural soils of the region are grouped as being of autochthonic and transported origin. The former group includes true red soils, calcareous red soils, siliceous soils, argillaceous soils, calcareous sandy soils, siliceous marl, marly soil, calcareous marly soil, and calcareous dolomitic soils. The latter group includes calcareous clay detritus, calcareous gravel, siliceous sand, clay and marl soils, and sandy clay soils.

Investigations and experiments at the Moor Experiment Station in Bremen, B. TACKE (*Mitt. Ver. Förd. Moorkult. Deut. Reiche*, 39 (1921), Nos. 10, pp. 227-232; 11, pp. 243-247).—The first two studies of a series conducted on moor soils are reported in these papers.

I. *The action of ammonium bicarbonate on moor and sand soils.*—Pot experiments begun in 1915 with oats on upland moor soil and sand soil, to determine the value of ammonium bicarbonate as a source of nitrogen as compared to sodium nitrate and the fertilizing value of a mixture of ammonium bicarbonate and superphosphate, are reported.

The ammonium bicarbonate is a product of the introduction of an excess of carbon dioxide into ammonia solution. It was applied as a top-dressing and also mixed with the soil to a depth of 5 cm. (about 2 in.). Its nitrogen was as active and in some cases more so than that of sodium nitrate. The superphosphate mixture was not very effective as a phosphoric acid fertilizer on the moor soil, but gave good results on the sand soil which was deficient in phosphoric acid.

II, *Pot experiments with lowland moor soil.*—Experiments begun in 1918 on a lowland moor soil rich in nitrogen are reported in which the influence of fertilization with phosphoric acid and potash was studied, with particular reference to the relation between grain and straw in the oats and rye crops. No indications of exhaustion were evident the first two years. In the third year there was marked evidence of an exhaustion of natural potash in the soil, and also some evidence of phosphoric acid exhaustion. These results are taken to indicate the relatively small supply of available phosphoric acid and potash in such soils. A heavy fertilization with either potash or phosphoric acid alone did not produce a marked increase in crop. In the third year where no potash was added the ratio of grain to straw was very wide. This ratio approached the usual field ratio on treated soils in the last two years, and was much narrower than during the first year. Where potash was applied

there was a relatively large increase in grain yield as compared to the straw yield.

It is concluded that on moor soils which are rich in nitrogen the question of potash exhaustion should be considered in connection with efforts to increase the ratio of grain to straw. The ratio of the available phosphoric acid and potash in the soil may also be of considerable significance in this connection.

A successful cooperative experiment on a potash-hungry peat of doubtful lime requirement, F. J. ALWAY, P. R. McMILLER, and C. O. ROST (*Jour. Amer. Peat Soc.*, 14 (1921), No. 3, pp. 5-18, pls 4).—An experiment conducted by the Minnesota Experiment Station on the Forest Heights, Minn., bog is reported, in which clover, barley, flax, corn, sunflowers, potatoes, beets, and cabbage were used as trial crops. The soil is a typical peat from 1 to 5 ft. deep, of distinctly acid reaction and so low in lime that its requirements for the mineral were doubtful.

It was found that the lime supply was sufficient, and that the addition of lime was without beneficial effect on crop yields. The use of nitrogenous fertilizers was also unnecessary, but applications of both potash and phosphate were essential for maximum yields. Potash used alone was of marked benefit to most crops, but phosphate used alone was without effect and in some cases detrimental.

The improvement of peaty soils.—II, The silty and sandy peats, E. J. RUSSELL (*Jour. Min. Agr. [London]*, 28 (1921), No. 1, pp. 32-35).—In a second contribution to the subject (*E. S. R.*, 45, p. 422), analyses of silty and sandy peat soils found in different localities in England are presented and discussed, and methods for their improvement are described.

These soils are said to form a transition between the true peats and true soils. They occur in conditions where bacterial action proceeds more slowly than in ordinary soils and more quickly than in true peats. They present greater possibilities for reclamation than the peats and usually have the same defects, such as wetness, acidity, and lack of phosphates, but in a less intense form.

The claying of fen soils, W. S. MANSFIELD (*Jour. Min. Agr. [London]*, 28 (1921), No. 5, pp. 412-418, pl. 1).—The method of claying true fen soils which are light, black in color, and contain a very high percentage of organic matter is described and illustrated.

The top soil may contain over 50 per cent of organic matter, and in the subsoil the high organic content is even more marked until a layer of unadulterated peat is struck. Under the peat is either sand and gravel or clay. Black land overlying clay is said to be superior in every way to that overlying sand and gravel, and if the clay is within 4 ft. of the surface the process of claying the top soil is facilitated and cheapened.

In the process of claying, parallel trenches are excavated 13 yds. apart across the field and the clay under the subsoil distributed over the surface soil. The excavated peat and organic soil is returned to the bottom of the trench and serves to improve drainage conditions. Such treatment is valued on a 7-year basis, but it is thought that its effects will last for 15 years. The most important benefits seemed to be consolidation and drainage.

Investigations in dry farm tillage, M. A. McCALL and H. F. HOLTZ (*Washington Sta. Bul.* 164 (1921), pp. 56, figs. 12).—In this bulletin experimental data are presented and discussed which are based on conditions as they exist in those parts in the State of Washington where the annual rainfall is 15 in. or less. The soil types in that region vary with elevation and rainfall, the sandier soils being found at the lower elevations, as is also the lightest rainfall. The

soil types range through sandy soils, fine sandy loams, very fine sandy loams, and silt loams. The sandier types are subject to drifting.

Field experiments were conducted at the Adams Substation on two series of $\frac{1}{10}$ -acre plats, which were alternately fallowed and cropped, one series being in fallow and one in crop each year. All were treated the same, except in preparing and maintaining the fallow.

Under the conditions of the localities in question moisture is the direct limiting factor in crop production, and the summer fallow system of tillage for the conservation of moisture is necessary. Moisture conservation is said to depend on the absorption and retention of precipitation, and tillage operations should be planned to control these processes in so far as possible. In this district the regulation of absorption is considered to be the most important factor in determining tillage methods. With a light intermittent rainfall, followed by drying winds, a comparatively firm soil condition was found to favor absorption the most, while a loose soil condition hinders the process. Under conditions where a loose soil is unfavorable in moisture absorption, the detrimental effect is in direct proportion to the loose soil.

At a moisture content near the field capillary capacity for a given soil type the soil tends to settle or naturally refirm itself to the greatest degree after stirring. Under such conditions plowing or other tillage may be deeper without an equally detrimental effect on absorption. At a lower moisture content a soil tends to remain in a more loose condition after being stirred. As the moisture content of the plow layer diminishes, it is pointed out that plowing or other tillage should be more shallow in order to avoid the detrimental effect of the loose soil on absorption.

The lower the average rainfall, the more shallow should be the average depth of plowing. In general, depth of plowing should decrease with the advance of the spring season. Retention of moisture is best accomplished by early spring preparation of the fallow and the control of weeds. Variations in soil type and in the average annual rainfall give varying results from any specified operation or system.

Efficiency of fertilizers and other manures (*Rhode Island Sta. Rpt. 1920, pp. 7-9*).—The results of general fertilizer studies to determine the best sources of the important fertility constituents for different crops are briefly summarized.

Artificial farmyard manure, H. B. HUTCHINSON and E. H. RICHARDS (*Jour. Min. Agr. [London], 28 (1921), No. 5, pp. 398-411, figs. 2*).—Experiments conducted at the Rothamsted Experimental Station to investigate the possibility of converting straw into manure without the intervention of live stock are reported.

From these experiments a method was devised by which straw can be converted into a substance having many of the properties of stable manure. In a considerable number of preliminary experiments to secure obvious breakdown and color changes in fermenting straw, the most promising results were obtained when the straw was subjected to the action of a culture of aerobic cellulose-decomposing organisms (*Spirochaeta cytophaga*). Further inquiry developed that this effect was due mainly to the indirect effect of the mineral substances contained in the culture fluid.

It was found that the most essential factors making for the production of well rotted artificial barnyard manure are air supply, suitable temperature, and a suitable supply of soluble nitrogen compounds. It was established that characteristic breakdown changes in straw remain suspended when a free supply of air is excluded either by intense consolidation or by immersion of straw in liquid. The fermentation appeared, therefore, to be an essentially aerobic one, at least in its early stages, and the typical disintegration of the straw with the production of dark colored plastic material did not take place in the absence

of air. Also, the color of aerobically produced manure was rapidly reduced when oxygen was excluded.

Repeated experiments showed that the most rapid breakdown of straw occurred when some source of available or indirectly available nitrogen was supplied, and then only in those cases where the reaction of the solution was neutral or slightly alkaline. Neither ammonium sulphate nor caustic soda were effective in this respect, since with the former the medium soon became markedly acid and with the latter the nitrogen was lacking. The addition of nitrogen in the form of urine, urea, ammonium carbonat , or peptone within certain concentrations immediately caused rapid decomposition changes, resulting in the production of dark colored, well disintegrated, structureless material closely resembling well rotted manure.

It was brought out that it is of no less importance that the quantity of nitrogen added should not exceed a definite amount either actually or in concentration. If the concentration of ammonium carbonate produced from the decomposition of urine or urea exceeded a definite limit, straw breakdown changes were not only definitely held up but continued to be inoperative until by volatilization the concentration or alkalinity was reduced to the upper limit of growth of the microorganisms. This is regarded as particularly important since the highest concentration for rapid breakdown was found to be appreciably below that of the weakest undiluted urine. In this connection it was found impossible to produce well rotted manure by the use of neat urine without considerable losses. Further experiments showed that, in addition to the two phases in which straw overloaded with nitrogen loses it to a definite degree and in which straw with the requisite amount of nitrogen may undergo rotting without appreciable loss, there exists a third phase in which undersaturated straw, by the agency of microorganisms, exhibits a well marked property of picking up nitrogen, particularly in the form of ammonia, until the same final content of nitrogen in the rotted product is attained. It is therefore concluded that in two different but adjacent portions of fermenting straw, the one overloaded with and the other lacking nitrogen, the former portion loses and the latter accumulates nitrogen until a common level is approached.

In general it was found that when straw has worked from an unsaturated to a stable phase, little or no free ammonia is to be found, but that straw which commences with an excess of nitrogen appears to hold, when in a fermented state, upward of 14 per cent of its nitrogen in the form of ammonia so long as the material is in a moist condition. Desiccation led to almost complete loss of ammonia.

It is concluded that the amount of nitrogen necessary for pronounced rotting and the amount which straw is capable of fixing in the form of ammonia are identical, and that, in general the figure varies only between 0.7 and 0.75 parts of nitrogen per 100 parts of dry straw.

The experiments further showed that urea and ammonium carbonate are the most suitable carriers of nitrogen for this purpose, but owing to their cost alternative sources of nitrogen in the form of cyanamid and ammonium sulphate have been used with success. The latter, however, must be used with lime.

The mineral resources of the State of New York, D. H. NEWLAND (N. Y. State Museum Bul. 223-224 (1919), pp. 315, pls. 5, figs. 22).—This report is intended to serve as a general guide to the mineral resources of New York. It presents the principal facts regarding the character, occurrence, and production of the useful minerals with reference to particulars of the local features that bear upon their industrial utilization. It contains sections on gypsum, marl, peat, and limestone.

Origin of brown coal and kaolin in tertiary middle Germany, R. LANG (*Jahrb. Halleschen Verband. Erforsch. Mitteldeutsch. Bodenschätze*, No. 2 (1920), pp. 65-92, figs. 4).—Data from different sources are summarized to show that the brown coal occurrences in middle Germany were formed in a warm damp climate in deep swamps, and that the kaolin deposits owe their origin to the action of the run-off water from these swamps, which was saturated with raw humus.

The peat exhibit, W. L. FISHER (*Phila. Mus., Com. Mus. Handb. Exhibits*, No. 3 (1920), pp. 57, figs. 28).—This handbook describes the peat exhibit in the Philadelphia Commercial Museum. It embodies a brief statement of the formation and occurrence of peat and of its uses throughout the world. Special attention is called to the vast deposits of peat in the United States, and lines are suggested for their possible development.

Phosphate rock in 1920, R. W. STONE (*U. S. Geol. Survey, Min. Resources U. S.*, 1920, pt. 2, pp. 27-85, fig. 1).—Data on the production and export of phosphate rock in the United States during 1920 are reported and discussed.

It is stated that the phosphate rock sold in the United States amounted to 4,103,982 long tons, an increase of 80 per cent over 1919. The total quantity of phosphate rock mined in 1920 was 3,975,001 long tons, or an increase of 115 per cent over the output in 1919. South Carolina and Wyoming were the only States in which production decreased.

The stocks reported on hand at the end of 1920 were about 537,000 long tons as compared with 555,000 tons at the end of 1919. The stocks in Florida decreased from 521,000 to 470,600 tons, but stocks in Tennessee increased from 31,000 to 59,700 tons. Only about 5,500 tons of rock were on hand in South Carolina at the end of the year, and in Kentucky and the Western States the stocks were negligible.

In 1920, for the first time since 1913, exports were more than 1,000,000 tons.

The total output of phosphate rock in the Western States in 1920 was 55,609 long tons. It is also stated that during 1920 about 72,801 long tons of raw phosphate rock were sold for direct application to the soil.

Some experiments bearing on the results of exposure of superphosphate to ordinary weather conditions, A. J. PERKINS (*Jour. Dept. Agr. So. Aust.*, 24 (1921), No. 8, pp. 664, 665, 667-669).—Experiments to determine the influence of weather conditions on the chemical composition of superphosphate exposed in bags are reported.

Ordinary standard superphosphates containing 36 per cent of tri-calcium phosphate rendered water soluble were exposed to all weather conditions for 12 successive months. It was found on analyses at the end of this period that exposure to the weather resulted in a mean loss of 3.1 per cent of water-soluble phosphate, calculated on a moisture-free sample, with a maximum of 6.2 per cent. The loss of water-soluble phosphate by ordinary reversion was only about 1 per cent after 12 months' storage under cover.

It is concluded from these results that when bags of superphosphate are accidentally exposed to the weather the loss of soluble material is not so great as is usually supposed, and that aside from caking and subsequent sowing difficulties, the superphosphate will not suffer very materially from occasional showers. It is further concluded that an appreciable difference between the composition of the manure and the guaranteed analysis is not necessarily due to careless storage.

Results of phosphoric acid fertilization, ENGELMANN (*Deut. Landw. Presse*, 48 (1921), No. 39, p. 297).—Data from experiments with five different crops on the fertilizing action of complete and incomplete fertilizers are reported.

While nitrogen and potash fertilizers gave good results, phosphoric acid in the form of superphosphate gave negative results in a number of cases, both when used alone and when used in conjunction with other fertilizers. These results are taken to indicate the importance of a proper selection of fertilizers on the basis of the increased yields which can be obtained. It is concluded that with the present high price of superphosphate in Germany the highest profitable yield is not always to be obtained from a complete fertilizer.

The old and new phosphate fertilization, M. VON WRANGELL (*Arb. Deut. Landw. Gesell.*, No. 307 (1920), pp. 61-67).—The results of several series of studies are summarized which showed that crops vary widely in their ability to assimilate phosphoric acid from difficultly soluble phosphates. Crops with small assimilating capacity were not particularly aided in this respect by supplementary fertilization or by varying the soil reaction, except when a distinctly acid reaction was produced. Crops with large assimilating capacity for insoluble phosphoric acid were independent in this respect of supplementary fertilization and soil reaction.

Crops are therefore classed as phosphoric acid consumers and phosphoric acid dissolvers. Ash analyses of both types of crop showed about the same phosphoric acid content, but the second group showed an extraordinarily high lime content.

Changing sour soils (*Rhode Island Sta. Rpt.* 1920, pp. 12, 13).—The results of studies in progress on acid soils with high-magnesium and high-calcium limestones and other lime products are briefly summarized.

Actual cost of lime at the farm, E. O. FIPPIN (*Natl. Lime Assoc., Trade Bul.* 102 (1921), pp. [4], figs. 2).—Popular information on how to calculate the costs of different forms of lime are presented in this bulletin.

Lime and ground limestone.—Methods of production, W. L. NEWNHAM (*New Zeal. Jour. Agr.*, 22 (1921), No. 3, pp. 132-142, figs. 5).—Lime burning and grinding plants suitable for the individual farmer or an association of farmers in New Zealand are described and illustrated.

The successful recovery of potash as a by-product from cement kilns, C. KRARUP (*Chem. and Metall. Engin.*, 25 (1921), No. 8, pp. 316-320, figs. 2).—The difficulties encountered in placing the potash by-product industry in cement manufacture on a paying financial basis are discussed, and a description is given of a successful plant in which the cement dust is separated from the potash by spray washers prior to electrical precipitation.

Fertilizer experiments with gas plant waste water, R. OTTO (*Landw. Jahrb.*, 52 (1919), *Ergänzungs.* 1, pp. 76-81, figs. 2).—Fertilizer experiments with gas plant waste water on garden crops are reported. It is stated that this water contains from 1.5 to 3 per cent of ammonia and numerous different acids. It was found that the gas water is a useful fertilizer for garden crops and flowers. However, it was necessary to apply it to the soil as early as possible before planting, preferably in the winter, in order to prevent injury to crops. It could not be used to any advantage as a top-dressing, but was useful in a compost.

Coal and coke ashes as fertilizers, HEINE (*Landw. Jahrb.*, 52 (1919), *Ergänzungs.* 1, pp. 98-105).—Chemical analyses of coal and coke ashes showed that their composition varied widely, but that they were uniformly deficient in plant nutrients as compared to wood ashes. They were found to contain silica, iron, lime, and sulphur compounds. Both sulphids and sulphates were present.

Fertilizer experiments with these ashes on vegetable soils are reported, showing that while certain vegetables are undoubtedly sensitive to their toxic action, garden soils rich in humus may in general be profitably treated with as much

as 25 per cent coal and coke ashes some time before planting. Such treatment was found to favor plant growth and increase crop yields.

The opinion is expressed that the favorable action of coal and coke ashes on acid humus soil is due to their lime content and general alkalinity, and to their decomposing action on organic composts.

Experiments with "radio" manure.—The effect of coal dust on crops, T. H. PATTERSON (*New Zeal. Jour. Agr.*, 22 (1921), No. 3, pp. 162-166).—Top-dressing experiments with grass on heavy loam soil and with pasture on so-called gum soil, to determine the influence of so-called radio manure, are reported.

This manure is composed of a small amount of readily available phosphate, burnt lime, and coal dust. Its action was compared with that of the lime and phosphate alone and combined. Increases were obtained with this manure, but greater increases with superphosphate alone and with superphosphate and lime. The use of coal dust alone showed a depressing effect on grasses and clovers.

It is concluded that this fertilizer can not claim its value from the coal dust used but from the phosphate and lime it contains, and in addition that the coal dust adversely affects the good effects of the other ingredients. The experiments are to be continued.

Inspection of commercial fertilizers, P. H. WESSELS (*Rhode Island Sta. Ann. Fert. Circ.*, 1921, pp. 3-12).—This circular contains the results of actual and guaranteed analyses of 99 samples of fertilizers and fertilizer materials, including limes and wood ashes, offered for sale in Rhode Island during 1921.

AGRICULTURAL BOTANY.

Botany with agricultural applications, J. N. MARTIN (*New York: John Wiley & Sons, Inc.; London: Chapman & Hall, Ltd.*, 1920, 2. ed., rev., pp. XII+604, figs. 490).—In the preparation of this edition several portions of the text as originally presented (*E. S. R.*, 41, p. 96) have been rewritten in the interest of precision, clearness, and applicability to other lines of work. The most extensive changes are in the treatment of heredity and evolution. The subject matter and presentation remain otherwise practically the same. The new title is intended to express the more appropriately the character of the book and its purpose, which is to present the fundamental facts of botany, primarily, but as closely related to practical problems.

Elements of vegetable biology, L. CARAPEZZA (*Elementi di Biologia Vegetale. Palermo: Ant. Trimarchi*, 1920, pp. XXIV+184, figs. 155).—This elementary book is intended for use by academic and technical students.

A summary of forest botany and tree biology, L. CHANCEREL (*Précis de Botanique Forestière et Biologie de l'Arbre. Paris: Berger-Levrault*, 1920, pp. VII+284, figs. 191).—The first main section of this work (which is primarily devoted to forest growths) deals with the vegetable cell and its contents, materials derived from protoplasm, development and increase of cells, and vegetable tissues; the second with anatomy (morphology, external and internal, of angiosperms and gymnosperms); and the third with tree physiology, including properties of wood (physical and chemical), nutrition, and reproduction.

Agricultural bacteriology for students in general agriculture, H. L. RUSSELL and E. G. HASTINGS (*New York: Century Co.*, 1921, pp. XIV+368, figs. 63).—The main purpose of the text here presented is to give the essential facts concerning the relations of microorganisms to daily life (especially to that of the farm) without confusing detail. The bacterial diseases are chiefly those of animals, one chapter only dealing with plant diseases.

International catalogue of scientific literature. R—Bacteriology; QR—Serum physiology (*Internatl. Cat. Sci. Lit.*, 14 (1920), pp. VIII+354+132+22).—This volume contains mainly the literature of 1914, but as in previous issues (E. S. R., 43, p. 227) some of earlier years.

An ecological study of the Big Stone and Lake Traverse region of the Dakotas and Minnesota, L. H. PAMMEL (*S. Dak. State Hort. Soc. Ann. Rpt.*, 17 (1920), pp. 207-216).—The regions here considered embrace the watershed of the Red River of the North, draining toward the Hudson Bay, and that of the Minnesota River, draining toward the Gulf of Mexico.

Study of a section of the Oregon coast flora, M. E. PECK (*Iowa Acad. Sci. Proc.*, 26 (1919), pp. 337-362).—This paper, giving brief descriptive accounts of a large number of genera and species, represents a somewhat detailed study of a section of the Oregon coast in Lincoln County, some significant conditions in which are described.

Supplemental list of plants from southeastern Alaska, J. P. ANDERSON (*Iowa Acad. Sci. Proc.*, 26 (1919), pp. 327-331).—As a result of further collection and study of material (E. S. R., 37, p. 526), the author lists, as from localities indicated, approximately 30 families, 70 genera and 80 species.

Floral aspects of British Guiana, A. S. HITCHCOCK (*Smithsn. Inst. Ann. Rpt.*, 1919, pp. 293-305, pls. 12, figs. 3).—A popular account is given of the flora of British Guiana as observed by the author during a visit to that country in 1919 and 1920.

Flora of Jamaica, W. FAWCETT and A. B. RENDLE (*London: Brit. Mus.*, 1910, vol. 1, pp. XIX+150, pls. 32; 1914, vol. 3, pp. XXIV+280, pls. 5, figs. 113; 1920, vol. 4, pp. XV+369, figs. 114).—This work was planned to give a complete and systematic account of the flowering plants of Jamaica and was estimated to occupy six volumes, of which only three have yet become available. Volume 1 deals with the Orchidaceae, the remainder of the monocotyledons is to form the subject matter of volume 2, and the dicotyledons are estimated to occupy the remaining four volumes. The descriptions have been drawn up with special reference to specimens from the West Indies, use having been made of material from large collections, which are indicated.

New Zealand plants and their story, L. COCKAYNE (*Wellington: New Zeal. Bd. Sci. and Art*, 1919, 2. ed., rewritten and enl., pp. XV+248, pls. 65, figs. 14).—This book in its original form was chiefly an adaptation of material selected from articles published in newspapers and in magazines named, and was (it is stated) the first attempt to pursue the study of plant life in the New Zealand biological region as a whole along ecological lines. The treatment was elementary, though scientific names as well as concepts were employed. The book was used as a text in the university colleges. This (second) edition is virtually a new book, having undergone radical rearrangement and received much additional material.

Occurrence and causation of parthenogenesis among plants and animals, H. WINKLER (*Verbreitung und Ursache der Parthenogenesis im Pflanzen- und Tierreiche. Jena: Gustav Fischer*, 1920, pp. VI+231).—This contribution is said to present the results of studies carried on for a number of years. The respective chapters deal with the significance of parthenogenesis in *Chara crinita*, the occurrence of parthenogenesis among animals, the possibility of indefinite asexual propagation, the cause of parthenogenesis, and definitions of parthenogenesis and apogamy.

An extensive bibliography is appended.

Anatomical studies on the tribe Trifolieae, A. VÉCHOT (*Etudes Anatomiques sur la Tribu des Trifoliées. Thesis, Facult. Sci. Univ. Paris*, 1920, pp.

271, figs. 15).—This study includes species of the genera *Ononis*, *Medicago*, *Melilotus*, *Trifolium*, and *Trigonella*.

Interspecific hybrids in *Crepis*, E. B. BABCOCK and J. L. COLLINS (*Calif. Univ. Pubs. Agr. Sci.*, 2 (1920), No. 5, pp. 191–204, pls. 3).—In order if possible to throw some light on the relation between individual chromosomes and particular somatic characters, the authors have given considerable attention to the genetic investigation of *C. capillaris* (*virens*) and *C. tectorum*, which possess low chromosome numbers and are therefore convenient for the purpose of such a study.

It was found that in case of the interspecific hybrids here obtained reciprocal crosses are equivalent. The F_1 shows dominance of *tectorum* cotyledon characters and hybrid vigor, as expressed by the increased size of the seedling parts. Absence of complete organization and coordination of the functioning systems is noted as causing the death of the plant at the end of the cotyledon stage. This and other results here reported indicate the desirability of making preliminary experiments in hybridizing all the species of *Crepis* that give promise of having value for genetic investigations. Experiments with other species were begun.

Inbreeding and crossbreeding in *Crepis capillaris*, J. L. COLLINS (*Calif. Univ. Pubs. Agr. Sci.*, 2 (1920), No. 6, pp. 205–216, pls. 3).—The natural expectation that the germ plasm of an old wild species would be found on investigation by breeding experiments to have been largely purified of genes resulting in harmful and abnormal characters by the elimination of weak forms through natural selection was not sustained by the results of this work with *Crepis*, a partially cross-pollinated plant.

Inbreeding in this plant causes conditions in some ways similar to the conditions produced by inbreeding in maize. The maximum reduction appears to be reached in the third and fourth generations. Crossing the inbred strains with other strains produces vigorous, rapidly-growing F_1 plants. Inbred plants show a slower rate of development during growth. Some inbred strains showed pollen sterility by a reduction in the number of mature pollen grains.

On the selection of *Hevea brasiliensis* (*Roy. Bot. Gard. Kew, Bul. Misc. Inform.*, No. 4 (1920), pp. 113–119).—An account is given of contributions relevant to generative and vegetative selection in *H. brasiliensis*, with particular reference to high latex yield, which appears to be a resultant of several factors.

Steps are said to have been taken by Cramer at Buitenzorg looking toward the establishment of a standard garden containing every type of *Hevea*, in order to furnish abundant material for the breeding of desirable varieties.

Multiple allelomorphs and limiting factors in inheritance in the stock (*Matthiola incana*), E. R. SAUNDERS (*Jour. Genetics*, 10 (1920), No. 2, pp. 149–178, pls. 2, figs. 3).—Details and summaries are given of results in the study of varieties of *Matthiola*, including the intermediate form described in earlier accounts as half-hoary (*E. S. R.*, 35, p. 731).

It seems clear that the two familiar garden types, the fully hoary and the wallflower-leaved, are not isolated forms as hitherto considered but forms representing the end terms in a graded series, each member of which has a distinct appearance and behavior corresponding to its factorial composition. Between the two extremes occurs a series of forms which has been divided into two groups, the partially hoary and the subglabrous. The various intermediates are discussed in detail.

Plant colors, H. KRAEMER (*Amer. Jour. Pharm.*, 93 (1921), No. 6, pp. 414–416; also in *Pharm. Jour. and Pharm.* [London], 4. ser., 53 (1921), No. 3023,

p. 227).—A brief, systematic statement is attempted of what has been established regarding the characters and behavior of plant colorants.

Some experiments on the modification of color in plants, H. KRAEMER (*Amer. Jour. Pharm.*, 93 (1921), No. 6, pp. 416-418).—This paper reports experiments conducted some years previously with a view to modifying color in flowers.

Subsequent studies show that pigment in the flower is distributed in four ways. The pigments are usually in epidermal cells as in the rose and pansy, though the pigment may occur in subepidermal cells as in wild hyacinth, in mesophyll layers as in *Mertensia*, or in the conducting tissues surrounding the mestome strands in the flower as in blue hyacinth.

The present state of research regarding organic nutrition of plants, T. BOKORNY (*Landw. Jahrb.*, 51 (1917), pp. 141-173).—The author confirms his conclusions formerly reached (*E. S. R.*, 42 p. 433), naming organic substances found effective as nutrients for fungi and algae, respectively.

Plant foods, A. ANGIOLINI (*Coltivatore*, 67 (1921), No. 22, pp. 114-117, fig. 1).—A brief statement is made regarding the need and use by plants of nitrogen, phosphoric acid, and potash in the soil.

Studies on the food relations of *Fusarium lini*, Y. TOCHINAI (*Ann. Phytopath. Soc. Japan*, 1 (1920), No. 3, pp. 22-33).—It is stated as the result of systematic studies that inulin and glucose proved to be the best carbon sources and lactose to be the poorest carbon source for *F. lini*. Polysaccharids were favorable and organic acids unfavorable as carbon sources. Malic and fumaric acids have in some respects unequal nutritive value. This fungus in racemic acid solution seems to assimilate d-tartaric acid better than l-tartaric acid. Succinic acid is the most favorable carbon source among these acids. Phenol derivatives often check development.

As a nitrogen source, organic nitrogen compounds are superior to inorganic nitrogen salts. Ammonia nitrogen and nitrate nitrogen are equally good, nitrite unsuitable. Amids are generally good nitrogen sources, asparagin the best of all.

Developmental movements of plants, K. GOEBEL (*Die Entfaltungsbewegungen der Pflanzen und deren Teleologische Deutung*. Jena: Gustav Fischer, (1920), pp. VII+483, figs. 244).—The 10 sections of this book deal with the forms and phases of growth and other movements in plants and their apparent significance.

The physiology of light in plants, F. J. MEYER (*Naturwissenschaften*, 8 (1920), No. 43, pp. 842-851, figs. 5).—An account, mainly bibliographical, is given of studies regarding light (or darkness) and germination, growth, assimilation, movement, and the injurious effects of ultraviolet rays in connection with plants.

Excretion in plants, P. C. VAN DER WOLK (*Naturw. Wehnschr.*, 35 (1920), No. 41, pp. 645-651).—The author reviews synthetically a number of facts as preliminary to a more special study of plant excretion.

Respiration in sprouting barley, W. WINDISCH (*Wehnschr. Brau.*, 37 (1920), Nos. 20, pp. 174-176; 21, pp. 181-184, fig. 1; 22, pp. 189-191).—Data are tabulated herein with discussion regarding the conditions, results, and accompaniments of the germination of barley.

Transpiration in plants, A. BURGERSTEIN (*Die Transpiration der Pflanzen*. Jena: Gustav Fischer, 1920, pt. 2, pp. 264, figs. 18).—The present volume, said to be supplementary to the volume of the same title appearing in 1904, contains 31 chapters and a bibliography of about 500 titles.

Root contraction, M. B. CHURCH (*Plant World*, 22 (1919), No. 11, pp. 337-340, fig. 1).—A brief review of evidence is considered to show that roots become shorter during development, the parenchymatous tissues being the seat of activ-

ity, cork and vascular trace remaining passive, and the cork being ultimately crushed. A region may be distinguished where wrinklins appear and shortening may be measured, a second region where no wrinklins are visible (though shortening may be detected by measuring), and a region showing no change. In dicotyledons the trace curves in waving fashion, while in monocotyledons the vascular bundles remain practically straight.

The formation of organic acids by *Aspergillus niger*, F. ELFVING (*Ofvers. Finska Vetensk. Soc. Förhandl.*, 61 (1918-19), *Afd. A*, No. 2, *Art. 15*, pp. 1-23).—*A. niger* on a pure solution of dextrose or of saccharose is said to produce abundantly oxalic acid. This is later utilized in part by the fungus, which behaves similarly on solutions of milk sugar, mannit, inulin, dextrin, glycerin, and asparagin. Acid formation is increased by alkalinity in the solution, particularly at low temperatures. On a complete nutrient medium with ammonium chlorid or sulphate as nitrogen source, no oxalic acid is produced. Ammonium salts are necessary, but such salts of organic acids are not effective in this respect. Apparently the hydrogen-ion concentration is significant in this connection. Citric acid is produced along with oxalic acid, often in larger quantity, and is also utilized. Under favorable conditions, other salts are produced.

Racial differences are apparent as regards acid production. Calcium salts hinder the production of oxalic acid but not of citric acid. Oxalic acid appears to be formed, at least partly, otherwise than as the result of sugar decomposition, probably through the decomposition of complex compounds.

The influence of cold in stimulating the growth of plants, F. V. COVILLE (*Smithsn. Inst. Ann. Rpt.*, 1919, pp. 281-291, *pls. 27*).—This is a reprint of an article previously reported (*E. S. R.*, 44, p. 424).

The electrical treatment of seeds (*Scot. Jour. Agr.*, 3 (1920), No. 3, pp. 340-344).—Information is briefly presented in tabular form with discussion, as embodied in notes credited to Lauder regarding tests of the Wolfryn electrochemical process for the treatment of seeds to improve the yield and quality of economic plants. The experiments as detailed showed little or no influence of electrical treatment.

FIELD CROPS.

Field crop yields in New Jersey from 1876 to 1919, H. B. WEISS (*Sci. Mo.*, 13 (1921), No. 4, pp. 342-349, *figs. 10*).—A study of the average acre yields from 1876 to 1919 of corn, wheat, rye, oats, buckwheat, sweet potatoes, white potatoes, and hay disclosed that from 1880 to 1883 all of these crops except wheat and sweet potatoes began to yield less, the lowest points being reached in the years 1889 and 1890. From 1891 on, the average yields of most of the crops gradually increased, potatoes, sweet potatoes, and buckwheat at a faster rate than corn and hay. Retrenchment in the purchase of fertilizer because of falling prices for farm products, the discontinuance of the extensive use of greens and marl after 1875 in New Jersey, and unfamiliarity with commercial fertilizers, combining to produce a period of depression in the fertility conditions, are considered as possible causes of the variation rather than climatic factors and loss of natural fertility.

The rises of the 10-year average curves exhibited no tendency to follow definite cycles arrangeable into up and down periods, as all excepting that for oats showed a more or less gradual increase from 1891 on. From 1882 to 1890, about 36,000 tons of fertilizer were consumed each year, but from 1890 the tonnage gradually increased until at the present time about 150,000 tons are used annually. The curve of fertilizer consumption from 1890 on agrees with the 10-year average crop yield from that date, and it is assumed

that such fertilizers are in part responsible for the increase in average yields, especially for potatoes, and to a lesser extent for sweet potatoes.

About 75 per cent of the fertilizer tonnage is used in the southern two-thirds of the State, where the bulk of the white potato and all of the sweet potato crops are grown. Other crops, like corn and grass, are benefiting from the large amount of fertilizers used. North of this section are found the bulk of the wheat crop, about one-half of the rye, and practically all of the oat and buckwheat crops, while corn and hay are generally distributed over the entire agricultural section of the State. The fact that hay follows corn, potatoes, and wheat in the usual rotations practiced in New Jersey and receives less fertilizer than the other crops explains its slow rate of increase. Oats not being a cash crop, would naturally receive less attention, accounting for the little variation in the 10-year average curve. Buckwheat, a minor crop, received little or no attention in the way of improvement, but it showed a higher rate of yield increase than the other crops. Its success, insofar as increased yields are concerned, is held due to the improvement which took place generally.

In addition to the increased and intelligent use of commercial fertilizers as stimulated by the New Jersey Experiment Stations, other factors helping to increase yields are improved methods of soil management, seed selection, introduction and extension of the acreage of alfalfa and the other legumes, and increased efficiency in controlling injurious insects and plant diseases.

[**Report of field crops work in Rhode Island, 1920**] (*Rhode Island Sta. Rpt. 1920, pp. 9, 10*).—Tests of soy bean varieties for silage, and different legumes in drills with corn, trials of potato varieties and hybrids, and the progress of rotations, are described in continuation of previous work (E. S. R., 44, p. 32).

[**Cooperative experiments with field crops in Ontario**] (*Ontario Dept. Agr., Ann. Rpt. Agr. and Expt. Union, 41 (1919), pp. 9-35*).—Among the reports presented at the annual meeting of the Ontario Agricultural and Experimental Union at Guelph in January, 1920, were Results of Cooperative Experiments in Agriculture, by C. A. Zavitz, and Cooperative Experiments in Weed Eradication, by J. E. Howitt.

[**Report of field crops work in Antigua, 1917-1920**], F. WATTS (*West Indies Imp. Dept. Agr., Antigua Agr. Dept. Rpt., 1917-18, pp. 4, 8-13, 15-17, 18, 19, 26, 27, 28-31, pl. 1; 1918-19, pp. 6-15, 19-24, 24, 25, 27-29; 1919-20, pp. 4-10, 15, 16, 19*).—Continuing similar work noted previously (E. S. R., 40, p. 522), these pages report the progress of variety tests with sweet potatoes, cassava, yams, eddoes, tannias, and sugar cane; field trials with upland rice and miscellaneous fodder plants; breeding work with cotton; storage experiments with cowpeas and sweet potatoes; and information relative to the cotton, sugar, corn, and sisal industries. Results of variety trials with sugar cane have been noted from another source (E. S. R., 45, p. 434).

[**Report of field crops work in St. Vincent, 1919**], F. WATTS (*West Indies Imp. Dept. Agr., St. Vincent Agr. Dept. Rpt., 1919, pp. 4-12, 15-20, 21-24*).—The progress of experimental work and industrial development with field crops is described for the period April 1 to December 31, 1919, in continuation of similar work (E. S. R., 45, p. 33).

[**Report of field crops work in Tortola, British Virgin Islands**], F. WATTS (*West Indies Imp. Dept. Agr., Tortola Agr. Dept. Rpt., 1919-20, pp. 2-4, 6-8*).—This describes the continuation of work along the same general lines as noted heretofore (E. S. R., 41, p. 729; 42, p. 230).

Report of field trials, 1919-1921, compiled by V. R. S. VICKERS, V. C. FISHWICK, and G. H. GARRAD (*Kent Ed. Com. and Southeast. Agr. Col., Wye, Rpt.*

Field Trials, 1919-1921, pp. 1-11, 14-32.—Results are reported of variety tests with wheat, winter and spring oats and barley, potatoes, mangels, and sunflowers, and fertilizer tests with wheat and potatoes, conducted on the South-eastern Agricultural College Farm at Wye and on various farms in Kent during the years indicated.

[**Field crops work in Aberdeen, Scotland**] (*North of Scot. Col. Agr., Guide Expts. Craibstone, 1921, pp. 7-36, 39*).—This reports the progress of variety tests with oats, wheat, barley, potatoes, swedes, turnips, and mangels; date and rate of planting, size and source of seed, and fertilizer tests with oats and potatoes; fertilizer, liming, and seeding trials with turnips; grazing, fertilizer, and seeding experiments with pasture; and plat tests of miscellaneous grasses and forage crops conducted at Craibstone farm near Aberdeen.

Forage crops in Denmark, H. FABER (*London and New York: Longmans, Green & Co., 1920, pp. XII+100*).—In this volume the author explains the increase in the area of root crops in Denmark from 95,000 to 678,000 acres during the period 1888 to 1919, inclusive, by citing results of and developments following the feeding experiments of Fjord (*E. S. R.*, 6, p. 585); the comparative cultivation tests with strains of roots and grasses, conducted on behalf of the State Committee on Plant Culture, by Helweg (*E. S. R.*, 29, p. 431; 37, p. 736; 39, pp. 634, 639; 42, p. 135; 43, p. 638), and Lindhard (*E. S. R.*, 29, p. 431; 37, pp. 734, 735; 40, pp. 136, 232, 534); and the guaranty of seed as to purity, germination, and other data of analysis, and as to genuineness of the strain, through the control of the Danish State Seed Testing Station (*E. S. R.*, 46, p. 36).

Danish agriculture is discussed in a brief foreword by R. Greig.

[**Report of field crops work in Bihar and Orissa, India, 1919-20**], A. C. DOBBS ET AL. (*Bihar and Orissa Agr. Dept. Rpt. 1920, pp. 4, 5, 11, 12, 15, 16, 19, 20, 21, 23-25*).—Results of variety, fertilizer, and cultural trials with rice, wheat, cotton, sugar cane, and miscellaneous forage crops are reported in continuation of similar work (*E. S. R.*, 44, p. 433).

[**Report of field crops work in the United Provinces of Agra and Oudh, India, 1919-20**], H. M. LEAKE, A. E. PARR, and L. C. SHARMA (*United Provs. Agra and Oudh, Rpt. Admin. Dept. Agr., 1920, pp. 4-6, 1a, 3a, 4a, 10a, 11a, 13a, 14a; Agr. Stas. East. Circle Rpt. 1920, pp. 1-14; West. Circle Rpt. 1920, pp. 11, 12, 13-19, 20-23*).—The progress of experiments with various field crops is described in continuation of work noted heretofore (*E. S. R.*, 44, p. 632).

[**Report of field crops work in the Union of South Africa, 1918-1920**], I. B. P. EVANS, W. H. SCHERFFIUS, H. S. DU TOIT, M. VAN NIEKERK, and G. F. NUSSEY (*Union So. Africa Dept. Agr. Rpt. 1918-19, pp. 18, 19, 24, 25, 28, 29, 62-68, 73, 81-83, 141-143, 151-158; 1919-20, pp. 8, 9, 40, 53-55, 69, 70, 75*).—These pages outline as heretofore (*E. S. R.*, 41, p. 528) the work of the tobacco and cotton, grain, and dry farming divisions, and of the chief grain inspector for the period April 1, 1918, to June 30, 1920, inclusive. Results are given of laboratory tests of various plants for fiber, paper, dyes, food, and oil.

Sprays of both sodium arsenate, 4 oz.: 4 gal. of water, and sodium arsenite, 1 oz.: 6 gal., were effective in destroying heavy infestations of Mexican marigold (*Tagetes minuta*), a troublesome weed widely distributed throughout the Union.

A handbook on cotton and tobacco cultivation in Nyasaland, J. S. J. MCCALL (*Zomba, Nyasaland: Govt., 1920, pp. 85*).—A guide for prospective settlers, detailing the various factors and operations involved in the production of cotton and tobacco in Nyasaland.

Plant propagation (*Rhode Island Sta. Rpt. 1920, pp. 13, 14*).—Irish Cobbler seed potatoes obtained from Maine annually from 1914 to 1917, inclusive, and

grown at the station each year since in comparison with new northern-grown seed tubers, showed practically no deterioration until 1920, when they averaged 206 bu. per acre in comparison with a yield of 361 bu. from seed grown farther north. Although marked deterioration has been rare with this early variety, late varieties of the Green Mountain group have usually shown similar deterioration in spite of tuber selection. Green Mountain seed tubers grown in 1919 with fertilizer differing only in two amounts of nitrogen, of phosphorus, or of potassium, yielded from 18 to 27 per cent less in 1920 if grown in 1919 with the larger than with the smaller applications of these successive fertilizer elements.

Plantings of three corn varieties made May 11 produced a larger proportion of hard ears, less soft ears, higher total yields, and a higher weight per 100 selected ears than plantings of the same varieties made June 7, exhibiting a behavior similar to that noted heretofore (E. S. R., 44, p. 32).

The rotation explained (*Min. Agr. Prov. Quebec Bul. 70 (1921), pp. 23, pls. 2, figs. 2*).—A practical discussion of the advantages, characteristics, and application of the rotation in crop production.

The Food and Drugs Act as it applies to the adulteration of grain, R. E. DOOLITTLE (*Grain Dealers Jour.*, 47 (1921), No. 7, pp. 493-495; also in *Amer. Elevator and Grain Trade*, 40 (1921), No. 4, pp. 304, 305; *Grain Dealers Natl. Assoc. Proc.*, 25 (1921), pp. 36, 37).—In a paper presented at the twenty-fifth annual meeting of the Grain Dealers National Association at Chicago, October 3-5, 1921, the author states that the Food and Drugs Act of June 30, 1906 (E. S. R., 17, p. 1034; 18, p. 459) applies to grain now in exactly the same manner as it did before the passage of the Grain Standards Act of August 11, 1916 (E. S. R., 36, p. 442). The position of the U. S. Department of Agriculture regarding the bleaching of oats and the mixing of barley and other grains with oats is also explained.

The miller's almanac (*Miller's Almanack, 1920-21, pp. 320, figs. 59*).—A compilation of statistical and general information of the milling industry and the grain trade.

The weighing of market hay, G. A. COLLIER and H. B. McCLURE (*U. S. Dept. Agr. Bul. 978 (1921), pp. 30, figs. 6*).—The various methods and practices involved in weighing market hay are described and compared in an endeavor to improve marketing facilities and to discontinue careless, inefficient, and unprofitable practices. The procedure in weighing by the bale, weighing at warehouses, weighing on wagon scales, and weighing on railroad track scales is detailed, together with an account of methods of recording weights and tagging. Copies of official weight certificates used in several important hay markets are included. The authors emphasize the importance of care in weighing and ascertaining the correct tare, the reliability of the weighmaster, and proper records.

Inspection and grading of hay, H. B. McCLURE and G. A. COLLIER (*U. S. Dept. Agr. Bul. 980 (1921), pp. 16, figs. 3*).—Current methods of hay inspection and grading are described, and the relative merits of each method are specified for the benefit of producers, jobbers, country shippers, track buyers, commission men, terminal wholesalers and shippers, brokers, wholesale and retail distributors, and consumers of market hay. The authors endeavor to present the problems that confront each agency. The need for uniform grades (E. S. R., 44, p. 228) is indicated, and the potential value of such grades to the producer, shipper, and consumer, and the probable effect of their application to trade practices are set forth. "It is obvious that the only way to insure the uniform application of grades in all parts of the country is by the maintenance of an effective and unbiased inspection service open to all agencies engaged in marketing."

Inheritance of ramose inflorescence in maize, J. H. KEMPTON (*U. S. Dept. Agr. Bul. 971 (1921), pp. 20, pls. 16, figs. 6*).—The branched-ear variation, termed *Zea ramosa* by Gernert¹ is described and its behavior in hybrids (E. S. R., 37, p. 536) discussed.

Although in crosses between the ramose type and Gordo, a Mexican corn with very few tassel branches, the Gordo type of staminate inflorescence was dominant in a general way in the F_1 generation, the influence of the *Ramosa* parent was easily detected by measuring various parts of the inflorescences. The ears of the F_1 were normal and without branches. The F_2 segregated into normal and ramose plants, approximately one-fourth being ramose when classified from tassel appearances. However, the ramose segregates underwent alterations, retaining partially the characteristics of the Gordo parent, while conversely, the normal plants showed the effect of their *Ramosa* ancestry.

A great variability was noted in the general appearance of the tassels in the ramose group. Ears ranging in an unbroken series from the typical ramose to those without branches were obtained, and these forms were associated in a general way with similar conditions of the tassel. An F_3 grown from two open-pollinated ears, one branchless and the other with only four branches, but both from plants with tassels indicating their *Ramosa* parentage, ranged from typical ramose to normal in respect to the ears, although most of the tassels were intermediate between ramose and normal. In another ramose variation, said to be genetically identical with Gernert's variation but appearing three years earlier at Fall Brook, Calif., an intermediate ramose condition is common, and occasionally plants have the typical ramose staminate inflorescence in combination with normal unbranched ears.

Eighteen F_4 progenies grown from self-pollinated F_3 plants showed that the diversity observed in the F_2 and F_3 was inherited. Two from unbranched ears produced only ears without branches, but *Ramosa* ancestry was apparent in the tassels. On the other hand, the progeny of a self-pollinated ramose ear produced 1 typically ramose, 11 intermediate, and 4 unbranched ears.

"The appearance and behavior in inheritance of the intermediate ramose plants suggest a relationship with branched forms from nonramose stocks, and furnish evidences for the development of the single-spiked ear through a reduction of branches."

Pure seed in relation to community production of cotton, G. S. MELOY (*U. S. Dept. Agr. [Bur. Markets Pamphlet], 1920, pp. 13; also in China Jour. Min. Agr. and Com., 7 (1921), No. 1, pp. 1-5; China Cotton Jour., 2 (1921), No. 2, pp. 241-245*).—The value of pure seed and early and superior varieties in cotton production is indicated, and the manner in which seed is mixed in the field and at public gins described. "Running out" of seed generally occurs when the superior strain is crossed with inferior varieties in the field or mixed at the gin. An inferior variety may run out in like manner among cottons of superior character, but not without leaving its stain on the cotton of the community. True running out or degeneracy may be counteracted by careful roguing. Alluring advertisements are held responsible for the dissemination of many inferior varieties, and commercial practices are said to have encouraged the production of inferior cotton to the neglect of superior varieties. The advantages of pure seed and of community production of single varieties are set forth in considerable detail.

Cotton culture in Brazil, W. W. COELHO DE SOUZA (*A Cultura do Algodoeiro no Brasil. Rio de Janeiro: Min. Agr., Indus. e Com., Serv. Inform., 1921, pp. 110, figs. 15*).—This treatise details the cultural operations and field practices

¹ Amer. Nat., 46 (1912), No. 550, 616-622.

involved in producing the cotton crop in Brazil, and includes notes on the history and extent of the industry, marketing problems, insect pests, and diseases.

Summary of botanical research on cotton carried out in Egypt up to 1918, A. T. MCKILLOP ET AL. (*Egypt Min. Agr., Cotton Research Bd., Ann. Rpt., 1 (1920), pp. 103-112, figs. 2*).—Summaries of investigations conducted in Egypt prior to 1918 are given under the topics of methods of investigation, origin, and history of Egyptian cotton, descriptions of modern Egyptian cottons, heredity, cross-fertilization, selection, physiology, cytology, mycology, and general accounts.

Experimental work on cotton, 1920, A. T. MCKILLOP ET AL. (*Egypt Min. Agr., Cotton Research Bd., Ann. Rpt., 1 (1920), pp. 9-30, 31-34, 39, 73-75*).—Abbreviated accounts are given of experiments conducted under the Cotton Research Board of the Ministry of Agriculture, Egypt, during 1920, comprising studies of botanical characters of cotton varieties, extraction of pure lines and propagation of selected strains, comparative tests of Egyptian and foreign varieties, cultural trials, physiological studies, and irrigation tests.

Neither the application of a dressing of iron sulphate, nor spraying with a solution of liver of sulphur affected the rate of boll shedding appreciably. A permanent loss in weight, about 1 per cent with sound seed and 3 per cent with damaged seed, occurred in seed heated to kill pink boll worm. This treatment did not apparently affect either laboratory or field germination.

Pilion cotton, A. MCKILLOP ET AL. (*Egypt Min. Agr., Cotton Research Bd., Ann. Rpt., 1 (1920), pp. 52-60*).—Pilion is described as an early maturing and productive variety of Egyptian cotton. The combed lint is from 27 to 30 mm. in length, and is much coarser and weaker than that of Sakel, although similar in color. When compared with Sakel in 80's power loom twist, Pilion broke at about 6 lbs. less than Sakel. It is noted, however, that Pilion spun much better than it handled.

Djali bras, L. KOCH (*Dept. Landb., Nijv. en Handel [Dutch East Indies], Korte Ber. No. 20 (1919), pp. 7, pl. 1*).—Brief agronomic data are given on djali bras (*Coix lacryma jobi agrestis*) (E. S. R., 40, p. 658). See also a note on adlay (E. S. R., 45, p. 737).

Determination of the flexibility of textile fibers, F. HEIM and O. ROEHRICH (*Bul. Agence Gén. Colon. [France], 13 (1920), No. 156, pp. 1209-1216, fig. 1*).—The tensile strength of the individual filament is determined before and after knotting. The loss of resistance to breaking after knotting is considered a fairly accurate index of flexibility. The losses sustained are given for the following fibers, which are also ranked in the order of flexibility: Flax 17.7 per cent, agave 32.6, ramie 34, hemp 38.8, sunn hemp 49, jute 56.3, phormium 60.2, sisal 63, manila hemp 66.7, *Hibiscus cannabinus* 81.3, and *Urena lobata* 83 per cent. Tests made with the torsionmeter, while held less accurate, showed a general agreement with the foregoing.

[Flax retting in Canada] (*Canada Min. Agr. Rpt., 1919, p. 65*).—Water at 75° F. gave the most rapid and satisfactory ret of flax, requiring five days.

Cross-pollination of milo in adjoining rows, J. B. SIEGLINGER (*Jour. Amer. Soc. Agron., 13 (1921), No. 6-7, pp. 280-282*).—Yellow milo was planted in east and west rows, south of and adjoining rows of white milo of the same height and blooming at the same time, August 4 to 22, 1919, at Woodward, Okla. The wind was from the south, southwest, or southeast practically throughout the blooming period. Plantings of the main heads from the south row of white milo in 1920 revealed 5.38 per cent of cross-pollination, slightly less than that reported by Karper and Conner (E. S. R., 42, p. 34) from plants of white milo surrounded by yellow milo.

A study of hybrid oats, *Avena sterilis* × *A. orientalis*, S. WAKABAYASHI (*Jour. Amer. Soc. Agron.*, 13 (1921), No. 6-7, pp. 259-266).—The F₁, F₂, and F₃ generations of Red Rustproof (*A. sterilis*) × Black Tartarian oats (*A. orientalis*) were studied at the Washington Experiment Station as to the resistance to smut, sterility, color of floral glume, shape of panicle, dwarfness of culm, and correlations among these characters.

Resistance to smut was completely dominant and apparently caused by multiple factors. Sterility was comparatively high in the F₁ but decreased in succeeding generations. The black color of the floral glume of Black Tartarian behaved as a simple Mendelian dominant character, while the shape of the panicle was probably determined by multiple factors.

Some correlation apparently exists between dwarfness and sterility and smut susceptibility and dwarfness, possibly between smut susceptibility and white color of the floral glume, and between susceptibility and the side character of the panicle. Sterility, however, is neither correlated with the color of the floral glume nor the shape of the panicle.

Potato varieties, K. SNELL (*Arb. Forschungsinst. Kartoffelbau*, No. 5 (1921), pp. 79, pls. 2, figs. 10).—A discussion of the province and the relations of the different tuber and plant characteristics in group classifications and varietal descriptions. The principal types of German varieties are grouped as follows: Early or medium early maturity, Kaiserkrone, Nieren, Ella, and Primel types; late or medium late maturity, (a) with white or blue tubers, Up-to-date, Imperator, and Industrie types, (b) with red tubers, Narrow-leaved Wohltmann, and Broad-leaved Wohltmann or Daber types. The outstanding characteristics and varieties pertaining to these groups are given, and descriptions of 167 German varieties are arranged alphabetically.

Experiments with seed potatoes, O. SCHLUMBERGER (*Mitt. Biol. Reichsanst. Land u. Forstw.* No. 18 (1920), pp. 30-39, figs. 2).—Comparisons of the stem end with the seed end of the Beseler variety of potatoes in both transverse and longitudinal sections did not reveal striking differences in yield, number, and rate of growth of sprouts, or numbers of tubers produced. No particular eye showed superiority in sprout production.

The effect of the time of harvest on yields of early and medium maturing potatoes, W. F. KOERNER (*Illus. Landw. Ztg.*, 41 (1921), No. 59-60, pp. 267, 268).—Four early varieties of potatoes dug 12, 15, and 17 weeks (dead ripe) after planting produced average acre yields of 128.6, 227.1, and 259.1 bu. of tubers, yields per plant being 266, 470, and 536 gm., respectively. Three varieties of medium maturity harvested 12, 15, 18, and 20 weeks after planting averaged 180.4, 238.4, 289.1, and 424.1 bu., with average yields per plant of 373, 493, 598, and 882 gm., respectively. The tubers of the early varieties assumed the most weight during the second third of their development period, whereas in the medium varieties the maximum increase in weight took place shortly before the normal (dead ripe) harvest.

The potato in British Columbia, C. TICE (*Brit. Columbia Dept. Agr. Bul.* 86 (1921), pp. 75, figs. 78).—This bulletin comprises practical instructions for the culture, storage, and marketing of potatoes in British Columbia, with notes on varieties and control of insects and diseases. It is stated that while British Columbia produces but 3.6 per cent of the potatoes in the Dominion, the yield per acre exceeds that of any other Province, being comparable with those of Great Britain and Ireland.

A summary of the experiments on rice in Bihar and Orissa from 1912 to 1919, G. C. SHERRARD (*Agr. Research Inst. Pusa Bul.* 96 (1920), pp. 64).—The experiments summarized in this bulletin comprise cultural, seed selection, rate of seeding and transplanting tests, trials of chemical fertilizers, and

animal and green manures, and comparisons of the wet *v.* dry seed bed and transplanted *v.* broadcasted rice conducted at Bankipore Cuttack, Dumraon, and Sabour Experimental Farms in Bihar and Orissa. The progress of these experiments has been noted previously (E. S. R., 37, p. 824, 825; 44, p. 433).

Results of selection experiments with rice, L. KOCH (*Dept. Landb., Nijv. en Handel [Dutch East Indies], Korte Ber. No. 21 (1919), pp. 16*).—The author reports the continuance of observations on pure line selections (E. S. R., 41, p. 636) of rice.

The influence of injury on development and yield of rye, O. SCHLUMBERGER (*Mitt. Biol. Reichsanst. Land u. Forstw. No. 18 (1920), pp. 41, 42*).—Studies of the effect of injuries to various parts of the rye plant on development and yield are described in continuation of earlier work (E. S. R., 30, p. 438).

Removal of all green leaves at 24 weeks after planting produced a decided setback in the development of the spike and culm. Crushing the spike prior to exsertion resulted in a jagged appearance similar to that caused by hail. When the spike, before exsertion, was bent and cracked but not broken entirely, the effects varied according to the location of the injury. Death of the spike generally resulted in the case of injury to the lower internodes. When stalks but slightly lignified and still growing were injured, especially in the uppermost nodes, recovery was frequent and was accompanied by normal spike development. The damaged portions were scarcely noticeable at harvest, and grain yields differed only slightly from those of normal plants.

Star grass, S. M. STENT and H. A. MELLE (*Union So. Africa, Dept. Agr. Jour., 3 (1921), No. 3, pp. 271-276, figs. 4*).—Star grass (*Cynodon plectostachyum*), a perennial from British East Africa, is described as a more erect grower without the deep rooting underground stolons of kikuyu. The grass possesses a higher feeding value than other grasses, but it requires a long, warm season, a fertile soil, and a heavy rainfall. It can not contend with kikuyu or other aggressive grasses.

Tobacco growing in the Philippines, D. B. PAGUIRIGAN (*Philippine Bur. Agr. Bul. 34 (1919), pp. 26, pls. 9, figs. 2*).—Cultural and field methods involved in the production of tobacco in the Philippines are described, and suggestions are given for curing and preparing the product for the market.

The culture of Sumatra tobacco in Kamerun, R. THILLARD (*Agron. Colon., 6 (1921), Nos. 40, pp. 128-148, pl. 1, fig. 1; 41, pp. 174-194, pls. 2, fig. 1; 42, pp. 227-244, figs. 2; 43, pp. 23-40, pls. 2; 44, pp. 63-71, pl. 1, figs. 3; 45, pp. 89-96, pl. 1*).—This article outlines the development of the tobacco industry in Kamerun, describing environmental conditions, cultural and field methods, and curing and marketing practices, and indicating the principal insects and diseases in the region attacking growing and cured tobacco.

Topping of wheat liable to lodging, SCHREIBAU (Compt. Rend. Acad. Agr. France, 6 (1920), No. 14, pp. 360-363).—Wheat about 30 cm. (12 in.) in height and showing signs of heading is cut back with a scythe or header to one-half its height; and when again reaching 20 cm., if lodging still appears liable the plants are cut to 15 cm. a second time. It is said that the entire crop is rendered resistant to lodging whatever the height attained. While topping delays ripening and reduces the straw yield somewhat, the quality and quantity of the grain yields are improved.

A new seed-cleaning process, E. D. EDDY (*Sci. Agr., 2 (1921), No. 2, pp. 52-54*).—The process in question is said to utilize centrifugal force to separate particles of different specific gravity completely and instantaneously. A liquid carrier with a specific gravity intermediate between those of the materials desired to separate, is introduced together with the seed into a rapidly revolving bowl, and the seeds lighter than the liquid are forced to the center, while those

as heavy as or heavier are thrown to the circumference. Regulating the density of the liquid is said to bring under perfect control the proportions of the seeds going into the light and heavy separations. For cleaning clover seed, a liquid of a density of about 1.2 is usually required. Centrifugal action is again employed to remove the liquid from the cleaned seed, which are then dried quickly in an air drier. Approximately 3 minutes are required from the time the seed is first wet until all the loose moisture is thrown out by the extractor, and from 30 to 45 minutes are needed to thoroughly dry the seed.

Work of the seed inspection laboratory for the year 1920, F. S. HOLMES (*Maryland Sta. Bul.* 243 (1921), pp. 167-186).—Results of purity and germination tests are reported for 1,120 samples of seed and 44 samples of special seed mixtures collected during 1920.

Seeds (Scotland) regulations, 1921 (*Scot. Jour. Agr.*, 4 (1921), No. 4, pp. 465-473).—These regulations, effective August 1, 1921, concern transactions in field, garden, and forest tree seeds in Scotland under the Seeds Act, 1920 (E. S. R., 45, p. 833).

Water hyacinth, E. JOHNSON (*Calif. Dept. Agr. Mo. Bul.*, 9 (1920), No. 3, pp. 76-80, figs. 4).—A description of water hyacinth (*Eichhornia crassipes*) and its habits, with control methods.

HORTICULTURE.

[Horticultural investigations] (*Rhode Island Sta. Rpt.* 1920, pp. 11, 12).—Greenhouse tomatoes grown in sand supplied with chemical fertilizers yielded about as well during the first fruiting month as plants grown in sand with manure compost, but the total yield was less in the sand.

Mangels were sown in 1920 in a soil which had been treated with lime and ashes since 1910. The poorest yield, 22.8 tons per acre, was obtained on a plat on which the same crop had been grown the preceding two years. A contiguous plat which had been in rutabagas during the same period yielded 39.8 tons. Liming is believed to have obliterated any effect of the preceding crops except in the case of mangels after mangels.

On a field where the acidity had not been treated, sugar beets and spinach grew better following a single year's growth of tobacco and parsnips than after sugar beets, spinach, peppers, and buckwheat. Late cabbage, following spinach, potatoes, beets, and peas grown in the same season under like conditions, yielded on a three-year average 10.33, 9.47, 8.91, and 7.43 tons per acre, respectively. The good growth of tobacco on acid plats indicated that this crop may be placed in the low lime-requirement class. Cotton was apparently in a different group in this respect than tobacco. Parsnips were considerably benefited by lime but not so much as beets and spinach. Pepper plants were not so sensitive to acidity as were any of the latter three crops.

Winter storage of fruits and vegetables, J. L. STAHL (*Washington Sta., West. Wash. Sta. Bimo. Bul.*, 9 (1921), No. 5, pp. 66, 67).—Concise practical information is given relative to the home storage of several common fruits and vegetables.

Where the big freeze hit, E. V. WILCOX (*Country Gent.*, 86 (1921), No. 25, pp. 6, 7, 26, 27, figs. 4).—A comprehensive report upon the nature and extent of the freeze injury to the 1921 fruit crop.

Fruit farming: Practical and scientific, C. H. HOOPER ET AL. (London: Lockwood Press, 1921, 2. ed., rev. and enl., pp. [VI]+195+[5], pl. 1, figs. 77).—A symposium on fruit growing with particular reference to the British Isles (E. S. R., 29, p. 837).

Results of fruit culture on the Forest Nursery Station at Indian Head, N. M. Ross (*Sci. Agr.*, 2 (1921), No. 2, pp. 50, 51).—This paper, read before the Official Horticulturists' Association of the Northern Great Plains, discusses the behavior of several fruits at Indian Head, Sask.

Among red raspberries, all varieties of which have to be laid down and covered during the winter season, Herbert has proved most satisfactory on account of the size of the individual fruits and the total yield, and Latham (Minnesota No. 4) shows promise. Everbearing strawberries have not given satisfactory results, and during the winter of 1919-20 suffered severely from winterkilling, while Senator Dunlap hibernated well. Sapa, Oziya, and Opata, three of the Hansen hybrid plums, show promise. Tokata, another of the group, is deemed the best eating variety so far grown. Grafts of Wealthy and Charlamoff apples bore a fair crop in 1921. Of an original planting of over 1,000 Wealthy seedlings, 30 odd were sufficiently hardy to merit continued trial, and of these, one shows particular merit.

The possibility of the transmission by asexual propagation of the high-yielding ability of individual apple trees, M. B. DAVIS (*Sci. Agr.*, 2 (1921), No. 4, pp. 120-124, fig. 1).—A contribution from the Central Experimental Farm at Ottawa, Canada, presenting the results of an experiment in bud heredity in the apple.

The investigation was begun in 1906, when Wealthy scions from trees of different yielding capacities, based on records taken since 1896, were root grafted on Rose of Stanstead and Dartmouth crab seedling stocks, the variability of which the author admits may have exerted a slight influence on the results. The average total yield per tree for nine years for the 17 trees propagated from the heaviest yielding parent was 57.18 gal.; for the 12 trees from the heaviest and most regular bearing tree, 48.37 gal.; and for the 8 trees propagated from the lowest yielding tree, 35.22 gal. The vegetative growth of the three respective groups, as indicated by actual observations and measurements of the circumferences of the trunks, varied in accord with the yielding capacities. The average circumference of the 17-tree group was 15.9 in., of the 12-tree group 14.77 in., and of the low-yielding 8-tree group 13.7 in.

As a check to this experiment, scions from the original three parent trees were top-grafted on each of 5 large bearing trees in the Russian orchard, locating the scions in alternate positions so as to obviate variations in light and heat factors. Yield data for the 5-year period 1911-1915, presented in tabular form, indicate a distinct gain in yield in favor of the two high-yielding parents. In this case the progeny of the heaviest yielding and the most regular bearing tree gave slightly the largest yield.

Hood River apple orchard management with special reference to yields, grades, and value of fruits, G. G. BROWN (*Oregon Sta. Bul.* 181 (1921), pp. 36, figs. 7).—An economic study of commercial apple production in the Hood River Valley based on data obtained from 51 widely distributed orchards during the six-year period 1913-1918. The prime purpose of the investigation was to determine the underlying factors leading to success on the one hand and failure on the other, and hence records were taken of varieties grown, spraying and cultural practices, amount of fruit produced per acre, and comparative quality of fruits from the various orchards, and, incidentally, costs of the various operations.

It was found that wide variations in practice existed, leading to wide variations in yields and returns per acre. Delicious was found to be the highest producing and highest selling variety. Dividing the six years into two periods, it was found that the growing of cover crops, the use of nitrate of soda and other improved practices of the second period had increased the yield from a general

average of 215 boxes per year for the first period to 314 boxes for the second period. The data as a whole show the value of a well-planned and carefully conducted system of management.

Insect and fungus enemies of the grape, A. L. QUAINANCE and C. L. SHEAR (*U. S. Dept. Agr., Farmers' Bul. 1220 (1921), pp. 75, figs. 79*).—A compilation of information relative to the insect and fungus enemies of the grape in the United States, presenting methods of control and discussing the preparation of various insecticides and fungicides, including arsenate of lead, nicotin solutions, and Bordeaux mixture.

Walnut culture in California, L. D. BATCHELOR (*California Sta. Bul. 332 (1921), pp. 141-218, figs. 36*).—A comprehensive discussion of walnut production in California, including climatic, soil, and water requirements; varietal descriptions; propagation; establishment of the orchard; general cultural requirements, including soil management, cover cropping, irrigation, intercropping, fertilization, and pruning; insects and disease pests and their control; harvesting; curing; packing; and costs of production.

Propagation of dates from seeds, [L.] TRABUT (*Compt. Rend. Acad. Agr. France, 7 (1921), No. 33, pp. 718-722*).—In comparing propagation by seedage and offshoot, the author points out that despite the general use of the offshoot method, if certain limitations could be overcome seedage would permit of much more rapid multiplication and at the same time prevent insect contamination from old trees. Since seedlings flower in the second year, male trees may be quickly discarded. It is believed that by the use of pollen from selected male parent trees possessing desirable characters the number of poor seedlings now obtained as a result of the use of unknown pollen would be materially reduced. The work of American investigators (E. S. R., 41, p. 342) in the use of improved male parents is cited.

The lychee and lungan, G. W. GROFF (*New York and Canton, China: Canton Christian Col.; London: Kegan Paul, Trench, Trübner & Co., Ltd., 1921, pp. [VI]+188, pls. 41*).—A compilation of historical, botanical, and cultural knowledge relating to the litchi (*Litchi chinensis*) and the longan (*Euphoria longana*) in the Canton district of China. An extended bibliography of Chinese and western literature and the following brief articles by investigators of the U. S. Department of Agriculture relative to the introduction of the litchi into the United States are appended:

The lychee (L. chinensis) a mycorrhizal plant, F. V. Coville (pp. 151, 152).—This paper discusses an experiment in which it was found that acid soil favors the growth of the litchi and promotes the development on the roots of tubercles containing mycorrhizal fungi which, apparently, are beneficial to the plant.

Lack of winter dormancy and the low zero point of growth of the lychee limiting factors in its culture in Florida, W. T. Swingle (pp. 153-156).—A study of the comparative climatical conditions of the Canton area with those of southern Florida showed that the winter temperature in Florida is higher, thus stimulating an unseasonable growth in the litchi and rendering it susceptible to winter injury.

Rooting lychee cuttings by means of a high temperature and high humidity process, E. Goucher (pp. 157-159).—A method is described whereby litchi cuttings placed in a hot moist chamber and so supported that the base barely touched the sand and soil mixture were successfully rooted.

Bulbs and bulb bloom, L. S. STEVENSON (*Canada Expt. Farms Bul. 48, 2. ser. (1921), pp. 26, figs. 13*).—This paper, largely a presentation of general cultural information relative to the utilization of various species of bulbs in the home and in the garden, contains miscellaneous experimental data, including a study

of the effect of time of removal of tulip blooms on the weight of increase of bulbs, which showed that cutting at full bloom was very satisfactory in this respect. Early digging of tulip bulbs was found deleterious in that the best degree of maturity was not reached until June 30. A dilution of 1 oz. of formalin in 1 gal. of water proved an effective remedy for tulips infected with Mucor and Sclerotinia diseases. A test of seven methods of storing tulip bulbs during the rest period indicated that storing in bulk in dry wood ashes was the most satisfactory treatment.

The complete garden, A. D. TAYLOR (*Garden City, N. Y., and Toronto: Doubleday, Page & Co., 1921, pp. XXVIII+440, pls. 63*).—The author, with the assistance of G. D. Cooper, here presents an enlargement and revision of the treatise previously noted (E. S. R., 35, p. 647), including comprehensive information relative to ornamental trees and plants, their general cultural requirements, and proper utilization.

FORESTRY.

The practice of silviculture, R. C. HAWLEY (*New York: John Wiley & Sons, Inc.; London: Chapman & Hall, Ltd., 1921, pp. XI+352, figs. 80*).—This book, prepared primarily as an educational text with particular reference to forestry in the United States, contains much practical information and many references to the literature.

The more important trees of British Columbia, J. KAY (*Quart. Jour. Forestry, 15 (1921), No. 2, pp. 134-142*).—Three species, *Pseudotsuga taxifolia*, *Tsuga heterophylla*, and *Thuja plicata* (Douglas fir, western hemlock, and western red cedar), are discussed in relation to distribution, habit of growth, and economic uses.

The timber trees of the State of Sao Paulo, Brazil, H. PEREIRA ([*Sao Paulo*]: *Dept. Agr., Com. and Pub. Works, pp. 86, pls. 27*).—A small pamphlet containing brief descriptive accounts of over 150 timber species, including information relative to specific gravity and uses.

The relation of frost injury to various forest planting methods, E. WIBECK (*Meddel. Statens Skogsförsöksanst., No. 17 (1920), pt. 5-6, pp. 329-347, figs. 3*).—This paper, with a German summary, is a contribution from the Swedish Forestry Experiment Station, presenting the results of an investigation of the comparative value of several planting and seeding practices in Norrland. The experiments, located on typical forest soils and so scattered geographically as to give a comprehensive value to the results, included tests of three methods of sowing, namely, broadcasting with tillage, broadcasting without tillage, and drilling with tillage, and two methods of planting, with mattock and with dibble.

Contrary to the expected results, sowing in unloosened soil and planting with the dibble gave the better results as measured by germination of seed and percentage of living transplants, except in the case of certain marshy soil types. Greater freezing injury is believed to be the cause of the increased losses in the loosened soils. Erosion following thaws is also thought to be a contributory factor.

It is concluded as a result of these studies that no set planting method can be recommended in the future. Since planting without loosening the soil is the much less expensive method, the experiments have a decided economic value.

An experiment in the spacing of fir trees [*Picea excelsa*], E. ZEDERBAUER (*Mitt. Forstl. Versuchsanst. Mariabrunn; abs. in Centbl. Gesam. Forstw., 46 (1920), No. 11-12, pp. 336, 337*).—In a study at the Mariabrunn Experimental Station, Austria, it was found that planting distances had a marked effect on

the manner of root development of young firs (*P. excelsa*). The experimental trees, four years old at setting in 1900, were originally planted 0.5 meter (about 20 in.) apart on a square system, and three years later part of the block were so thinned as to leave the remaining individuals 1.5 meters apart.

Examinations in 1910 of carefully lifted specimen trees indicated that the root system of the 1.5-meter-spaced trees was uniformly distributed in all directions, with a slight tendency to uneven development due, undoubtedly, to the first 3 years' growth at 0.5 meter. The root system of the 0.5-meter-spaced trees was characterized by the extraordinary development of one or two roots and the correspondingly weak development of the balance. Records taken of the weights of the roots and top and of the height and diameter of the top showed superior development of the 1.5-meter trees, thus indicating to the author that in order to secure sturdy trees with well-balanced root systems, able to resist winds, young transplants should be set from 1 to 2 meters apart, with further thinning at a later date.

Thinnings (*Indian Forester*, 47 (1921), No. 11, pp. 453-459, pl. 1).—A brief article discussing methods of thinning forest growths and presenting some experimental results indicating the value of the operation.

Circumference measurements in two sal plats in Haldwani, one thinned in 1884 and the other untreated, showed an increment of 13.7 in. per tree for the thinned and 7.5 in. for the untreated. It was found that the acceleration due to thinning was of comparatively short duration, leading to the suggestion that "the golden rule is to begin early, thin moderately, and repeat as often as necessary."

Measuring and marketing farm timber, W. R. MATTOON and W. B. BARROWS (*U. S. Dept. Agr., Farmers' Bul.* 1210 (1921), pp. 61, figs. 20).—A revised and enlarged edition of *Farmers' Bulletin* 715 by the same authors (*E. S. R.*, 35, p. 453).

Matches and matchwood production, G. A. WILMOT (*So. African Jour. Indus.*, 4 (1921), No. 10, pp. 826-837, figs. 10).—Following a discussion of the manufacture of matches, data are given relative to various species of woods growing in South Africa which are suitable for match production. *Populus serotina*, *Araucaria braziliensis*, *A. cookii*, *Pinus insignis* (*P. radiata*), and *P. pinaster*, are considered to be among the more desirable species. A tree of *A. braziliensis*, produced from seed sown in 1901, is said to have attained in 1921 a diameter of 24 in. and an approximate height of 55 ft.

Forest protection and conservation in Minnesota, W. T. COX (*Minn. Forest Serv. Ann. Rpt.*, 1920, pp. 32, pl. 1, figs. 11).—The annual report of activities of the Minnesota Forest Service for the year ended December 31, 1920, the principal feature of which was fire protection.

Forestry in Switzerland, P. FLURY (*La Suisse Forestière*. Lausanne: Libr. Payot & Co., 1914, pp. X+208+20, pls. 10, figs. 17).—A popular work published by the Swiss Society of Foresters, presenting a comprehensive review of forest activities throughout the whole Republic, and including studies of climatic and soil relations, forest species, experimental activities, legislation and organization, growth and production tables, and general economic considerations.

Forest resources, lumber industry, and lumber export trade of Finland, A. H. OXHOLM (*U. S. Dept. Com., Bur. Foreign and Dom. Com., Spec. Agents Ser.*, No. 207 (1921), pp. 144, pls. 12, figs. 15).—A report similar to that for Sweden (*E. S. R.*, 45, p. 141) and in like manner based on personal investigations by the author.

Report of the division of forestry, C. C. DEAM ET AL. (*Ind. Dept. Conserv., Ann. Rpts.*, 1 (1919), pp. 54-67; 2 (1920), pp. 285-293).—These reports for the

years ended September 30, 1919 and 1920, include accounts of activities in the Clark County State Forest, abstracts of publications issued during the period, and the usual fiscal statements. Brief notes are contained in the 1920 report on the behavior of about 30 species planted in the Clark County Forest.

Annual return of statistics relating to forest administration in British India for the year 1919-20 (*Brit. India Forest Admin. Statis., 1919-20, pp. 25, pl. 1*).—The regular report (E. S. R., 44, p. 742) relating to alterations in area, fire protection, grazing control, production, revenue, and expenditures, etc.

Report on forest administration in the Andamans for the year 1919-20, W. R. LE G. JACOB (*Andamans Forest Admin. Rpt., 1919-20, pp. III+41*).—The customary report (E. S. R., 45, p. 142).

Progress report of forest administration in the Province of Assam for the year 1919-20, A. W. BLUNT and F. H. TODD (*Assam Forest Admin. Rpt., 1919-20, pp. [82], pl. 1*).—The usual progress report (E. S. R., 44, p. 240) for the year 1919-20 on the administration and management of the State forests in Assam, presenting data relative to alterations in forest areas, forest surveys, working plans, protection, silvicultural operations, yields in major and minor forest products, revenues, expenditures, etc.

Progress report of forest administration in Baluchistan for 1919-20, F. W. JOHNSTON ET AL. (*Baluchistan Forest Admin. Rpt., 1919-20, pp. [26]*).—A report similar to the above on the State forests in Baluchistan for the year 1919-20.

Report of the forest administration of the Central Provinces for the year 1918-19, B. B. OSMASTON (*Cent. Prov. [India], Forest Admin. Rpt., 1918-19, pp. 22+6+LXXXV, pl. 1*).—This is the usual report of the chief conservator of forests relative to administration during the year 1918-19 (E. S. R., 41, p. 744), together with a brief review for the five-year period 1914-15 to 1918-19.

Administration report of the Forest Department of the Madras Presidency for the twelve months ended June 30, 1920, C. M. HODGSON, H. C. BENNETT, B. F. RIGOLD, C. E. C. FISCHER, ET AL. (*Madras Forest Dept., Ann. Admin. Rpt., 1920, pp. 76+LXI+17*).—The report for the 12 months' period ended June 30, 1920, contains the usual administrative and progress data (E. S. R., 44, p. 742).

Annual progress report of forest administration in the United Provinces for the forest year 1918-19, P. H. CLUTTERBUCK, R. C. MILWARD, and E. A. SMYTHIES (*United Provs. [India], Forest Admin. Ann. Rpt., 1918-19, pp. 5+38+CXVII+5*).—A report similar to that of the preceding year (E. S. R., 41, p. 744), but including in addition a review of forest activities for the five years' period ended 1918-19.

DISEASES OF PLANTS.

The garden doctor: Plants in health and disease, F. J. CHITTENDEN (*London: Country Life, Ltd.; New York: Charles Scribner's Sons, 1920, pp. X+154, pls. 32*).—This book is intended to give a short and simple account of some of the common troubles met with in gardens, and of control measures which have been found effective.

Plant disease and pest control, W. T. HORNE and E. O. ESSIG (*California Sta. Circ. 227 (1921), pp. 69*).—This is a revised edition of Circular 204, entitled Handbook of Plant Disease and Pest Control, which has been previously noted (E. S. R., 40, p. 543).

Three cases of plant anthracnose, T. HEMMI (*Ann. Phytopath. Soc. Japan*, 1 (1920), No. 3, pp. 13-21, pl. 1).—Descriptive discussion is given in German of a leaf spot of *Mahonia japonica*, attributed to *Gloeosporium* (*Colletotrichum*) *japonicum* n. sp.; another of *Illicium anisatum*, ascribed to *G. illicii*, n. sp.; and a stem and cotyledon disease of flax (*Linum usitatissimum*) plantlets associated with *Colletotrichum linicolum*.

The morphology and physiology of Japanese Gloeosporiums, T. HEMMI (*Jour. Col. Agr. Hokkaido Imp. Univ.*, 9 (1920), No. 1, pp. 159, pls. 3, fig. 1).—This work details the results of studies carried out with 49 *Gloeosporiums* on 34 cultivated plants.

The distribution of rust fungi in eastern Baltic regions, F. BUCHOLTZ and O. EKMANN (*Sitzber. Naturf. Gesell. Univ. Dorpat*, 26 (1918-19), No. 1-4, pp. 47-70).—The main results are given of a study of 24 species in 5 genera of Ustilaginaceae, and of 16 species in 6 genera of Tilletiaceae, with a tabular arrangement of the hosts in connection with the fungi.

Anthracnose of *Carthamus tinctorius*, T. HEMMI (*Ann. Phytopath. Soc. Japan*, 1 (1919), No. 2, pp. 1-11, figs. 2).—Studies subsequent to 1915 on a disease causing anthracnose of *C. tinctorius* evidence the causal agency of a fungus which is provisionally named *Gloeosporium* (*Colletotrichum*) *carthami* n. comb., and which is discussed as to its relationships.

On the morphology and the systematic position of *Cercospora persica* and *Clasterosporium degenerans*, R. TSUJI (*Ann. Phytopath. Soc. Japan*, 1 (1919), No. 2, pp. 23-35, pl. 1).—A fungus collected on peach leaves in 1917, in the Shizuoka Prefecture, proved to be identical with *C. persica* and closely related to *C. degenerans*.

On two species of *Ovulariopsis* from the West Indies, E. M. WAKEFIELD (*Roy. Bot. Gard. Kew, Bul. Misc. Inform.*, No. 7 (1920), pp. 235-238, fig. 1).—A discussion and technical descriptions are given of *O. gossypii* n. sp. on old leaves of Sea Island cotton (*Gossypium barbadense*), and of *O. obclavata* n. sp. on leaves of *Tecoma leucoxydon*.

Corn root rot diseases, T. F. MANNS and J. F. ADAMS (*Delaware Sta. Bul.* 128 (1921), pp. 3-24, figs. 15).—Descriptions are given of diseases of corn due to *Gibberella saubinetii*, *Diplodia zeae*, *Fusarium moniliforme*, and *Cephalosporium sacchari*. These fungi not only attack the ear but also produce root rots that greatly reduce the stand of growing corn.

For the control of these diseases the authors recommend seed selection and testing of seed before planting, and they describe a new type of rag-doll germinator which has been found well adapted to testing considerable quantities of corn.

Incidence of fungus diseases on the cereal plats, K. SAMPSON (*Welsh Plant Breeding Sta., Aberystwyth, [Bul.], Ser. C, No. 1* (1920), pp. 50, 51).—Remarkable severity of attack is noted as regards oat crown rust and wheat yellow rust. Black rust (*Puccinia graminis*) was abundant on rye stems used for paths between cereal plats. This rust was present on a few of the wheat plats and was noted on one stray oat plant in a bed of wheat, but was not recorded on barley. Brown rust (*P. secalina*) was common but not very injurious on rye in late June and July. *P. simplex* was also common on late-maturing barley in October. Wheat scab (*Fusarium culmorum*) was common, and is described as bad or very bad on seven varieties of *Triticum durum* and other varieties. Mildew (*Erysiphe graminis*) was recorded on oats, wheat, and barley. Ergot (*Claviceps purpurea*) was found on wheat, but not on rye. Smut (*Ustilago avenae* and *U. laevis*) attacked severely some varieties of oats. Wheat loose smut (*U. tritici*) was comparatively rare. Wheat smut (*Tilletia*

tritici) was present on one variety. *Helminthosporium gramineum* and *H. avenae* were noted on barley and oats, respectively.

Disease resistance: [Oat] crown rust, K. SAMPSON (*Welsh Plant Breeding Sta., Aberystwyth, [Bul.], Ser. C, No. 1 (1920), pp. 31-34*).—Tabular data show the severity of attack by crown rust on a number of varieties named. The desirability is indicated of investigating the host in relation to the parasite, as well as that of investigating the parasite in relation to the host.

Disease resistance: [Oat] smut, R. G. STAPLEDON (*Welsh Plant Breeding Sta., Aberystwyth, [Bul.], Ser. C, No. 1 (1920), pp. 28-31*).—Tabular particulars are given as to the incidence of smut on the plats as a whole in relation to the principal varieties, which are named, and to the source of origin of the seed grain. Marked differences in susceptibility are suggested.

Rye ergot on Manitoba wheat, J. CHIFFLOT (*Bul. Trimest. Soc. Mycol. France, 34 (1918), No. 3-4, pp. 192-194, pl. 1*).—The presence of rye ergot (*Claviceps purpurea*) on Manitoba wheat recently introduced into France is indicated, with discussion ascribing the morphology of the fungus as observed to the new habitat, and suggesting the name *C. purpurea tritici* or *C. purpurea tritici manitobae*.

Wheat blight (*Vie Agr. et Rurale, 10 (1921), No. 21, p. 335, figs. 5*).—Wheat blight as caused by nematodes is briefly described as to the course of development of the causal organism and of the disease.

Rust resistance trials with wheat [in Wales] (*Welsh Plant Breeding Sta., Aberystwyth, [Bul.], Ser. C, No. 1 (1920), pp. 41-49*).—T. J. Jenkins, in a general account of this work, reports in tabular detail on a portion of the 96 strains dealt with, regarding such characters as resistance to lodging, period required to ripen, cropping power, and resistance to black and to yellow rust. He also discusses in some detail oat black rust (*Puccinia graminis*), as regards its complicated life history on cereals, and combative measures, including barberry eradication and the use of resistant varieties.

K. Sampson reports briefly on yellow rust (*P. glumarum*), which is confined chiefly to wheat, occurring sparingly as a rule on rye or barley and not at all on oats. Yellow rust was very severe in 1920. Observations emphasize the condition of the host plant as to resistance or susceptibility factor at any given time. A yellow and brown flecking may be due, it is thought, to partially successful infections of *P. glumarum*.

It appears that generally autumn varieties are more susceptible to black rust and spring varieties to yellow rust, few varieties being equally resistant to both rusts. Yeoman, however, is highly resistant to both, ripens early, stands up well, and crops heavily.

Wheat scab and its control, A. G. JOHNSON and J. G. DICKSON (*U. S. Dept. Agr., Farmers' Bul. 1224 (1921), pp. 16, figs. 12*).—A popular account is given of the scab, or Fusarium blight, of wheat due to *Gibberella saubinetii*. In addition to wheat, the fungus also attacks rye, barley, and oats, and causes a rot producing disease of corn.

For the control of this organism the authors recommend rotations, planting clean seed, or seed that has been treated with formaldehyde or hot water, in well-prepared, clean land, and sowing in cool soil.

Take-all disease in wheat, R. WATERS (*New Zeal. Jour. Agr., 20 (1920), No. 5, pp. 287, 288*).—Notes are given regarding tests on the pathogenicity of *Ophiobolus graminis* for wheat stems and its connection with take-all disease.

Ophiobolus mycelium did not attack sterilized wheat culms in a glass tube, but it did attack wheat on sterile moistened soil. It is thought that the mycelium may attack below the ground level. If this is the case, it may spread from plant to plant by way of the roots or even of the soil.

The experiments, which are to be continued, are considered as having proved that *O. graminis* is a parasite of wheat and one of the causes of take-all.

It is noted that death occurred very quickly after inoculation (28 to 36 days), also that in all cases the plants first to die were those nearest the inoculum.

Studies upon the absorption and germination of wheat treated with formaldehyde, A. L. BAKKE and H. H. PLAGGE (*Iowa Acad. Sci. Proc.*, 26 (1919), pp. 365-375, figs. 2).—Results presented in this paper are considered to show that the absorption in the case of wheat seed placed in contact with formaldehyde in the usual concentration for treating seed to prevent smut is not materially different from that of wheat seed placed in water for the same period of time. Wheat seed soaked in a formalin solution for 10 minutes and kept inclosed for varying periods of from 1 to 36 hours does not show any impaired germination until after 26 hours.

A new rot of lupines, B. PEYRONEL (*Atti R. Accad. Lincei*, 5. ser., *Rend. Cl. Sci. Fis., Mat. e. Nat.*, 29 (1920), I, No. 5, pp. 194-197).—Young plants of *Lupinus albus* from the Rome Station for Vegetable Pathology were found in December, 1919, to be attacked by a rot in the underground portions. This trouble was ascribed to a fungus thought to be identical with that described as *Phytophthora terrestria* n. sp. by Sherbakoff (*E. S. R.*, 38, p. 251), but here proposed to be renamed *Blepharospora terrestris* for reasons which are presented.

Ascochyta on peas, L. C. DOYER (*Cultura*, 31 (1919), No. 374, pp. 382-385, fig. 1).—A brief account is presented in numerical, graphical, and descriptive form of the results of a preliminary study of *Ascochyta* on peas.

The inspection of potato crops during 1920 (*Jour. Min. Agr. [London]*, 27 (1921), No. 10, pp. 954-957).—Among the measures for the control of potato diseases, inspection and the exclusion of undesirable varieties are emphasized.

Blight appeared to be the most prominent disease. Leaf curl lowered the potato yield in many sections. This disease seems to be carried over from season to season and is common all over England, being most severe in the South. The disease is inheritable and infectious. Mottling was particularly severe on several varieties which are named. Blackleg was present in most districts in a small percentage. No variety appears to be immune.

Potato spraying trials in the Cambridgeshire Fens, 1919, F. R. PETHERBRIDGE (*Jour. Min. Agr. [London]*, 27 (1920), No. 3, pp. 282-286).—These experiments continue those previously reported (*E. S. R.*, 41, p. 656). The work of the year was planned to form part of the series of potato spraying trials extending over a term of years, and also to test the economic efficiency of machines applying over 200 gal. as compared with those applying about 100 gal. per acre.

The figures as presented with discussion suggest that it is unsafe to spray potatoes in the Fens in a season like 1919. It has been suggested that the scorching is due to the entrance of the spray into the punctures caused by insects.

A frost injury of potatoes, H. G. MACMILLAN (*Phytopathology*, 10 (1920), No. 9, pp. 423, 424, pl. 1).—A description is given of an injury to potatoes which was first thought to be due to flea beetles. Subsequent investigations proved that it was due to the plants having been subjected while moist to a low temperature.

Potato rot due to cold (*Vie Agr. et Rurale*, 10 (1921), No. 21, p. 336).—Potato rot due to cold may be caused by subjecting the tubers to -10° C. (14° F.) for one hour, to -5° for two hours, or to -3° for a longer period. Eyes are more resistant to cold than other parts of the tuber.

Potato leaf curl (*Jour. Min. Agr. [London]*, 27 (1920), No. 3, pp. 287-289, pls. 2).—This purports to give, after brief preliminary discussion, the text of a revision of the leaflet (No. 164) issued by the Ministry of Agriculture in 1918 on potato leaf curl. This account deals with a description of affected plants, the cause of leaf curl, and control measures.

The causation of leaf curl is still obscure. Strict choice of land for potatoes and of potatoes for seeding are relied upon as control measures.

Relation of climate to the development and control of leaf roll of potato, P. A. MURPHY and E. J. WORTLEY (*Phytopathology*, 10 (1920), No. 9, pp. 407-414, fig. 1).—The results are given of experiments and observations which are believed to account for the prevalence and spread of the leaf roll of potato in Prince Edward Island, and the occurrence of the disease in warmer climates. Sister tubers grown in Nova Scotia were planted in Prince Edward Island, Bermuda, and southern Ontario, and practically the same percentage of leaf roll occurred in each region. The presence of leaf roll in these cases demonstrated that the occurrence of the disease is due to infected seed and not to the climatic conditions.

Potato demonstrations [regarding disease and yield in 1919] (*Ontario Min. Agr. Rpt. 1919*, pp. 57-60).—Tabulation of data obtained shows, for the potato varieties Irish Cobbler and Green Mountain in northern Ontario, old Ontario, and New Brunswick, the yield in bushels per acre, also the percentage present of leaf roll and mosaic.

European potato wart disease, W. E. RUMSEY (*W. Va. Dept. Agr. Bien. Rpt.*, 4 (1919-20), pp. 47-51, fig. 1).—Potato wart was discovered in September, 1919, in a garden at Whitmer, Randolph County, and in 11 gardens in Thomas, Tucker County, W. Va. Plans indicated for combating the disease include sterilization of the soil, selection of resistant varieties, and quarantine.

The distribution of wart disease, H. V. TAYLOR (*Jour. Min. Agr. [London]*, 27 (1920), Nos. 8, pp. 733-738; 9, pp. 863-867; 27 (1921), No. 10, pp. 946-953).—Potato-wart disease (*Synchytrium endobioticum*) is discussed as to symptoms and history. A survey made at the end of 1919 shows that wart disease is widely spread throughout Great Britain, and that probably no county is free from this disease.

The second part of the report deals with the influence of the disease on the varieties grown. The third part gives details regarding immune or susceptible varieties, infected land, conditions influencing intensity of the disease, types, synonyms, and recording of characters of potatoes to insure identification of types.

Yellow dwarf, a new nematode disease of soy bean, K. KATSUFUJI (*Ann. Phytopath. Soc. Japan*, 1 (1919), No. 2, pp. 12-16).—*Glycine hispida*, one of the most important legumes of Japan, is increasingly attacked in southern Hokushu by a nematode, *Heterodera*, allied to *H. schachtii*, which is briefly discussed.

Sugar cane gummosis, J. MATZ (*Rev. Agr. Puerto Rico*, 5 (1920), No. 1, pp. 24-26, pl. 1).—A brief account is given of recent studies on sugar-cane gummosis, due to *Bacterium vascularum*, and apparently new to Porto Rico. Details are given as to its contrast with sugar cane matizado. Control measures recommended involve the selection of sound planting material or preferably of resistant varieties.

Diagnoses of fungi from spotted apples, A. S. HORNE (*Jour. Bot. [London]*, 58 (1920), No. 694, pp. 238-242).—During an investigation into the spotting of apples, commenced at Wisley in 1915, several fungi were isolated from the diseased tissue underlying the surface spots occurring on apples of many different varieties cultivated in Great Britain. Besides *Leptosphaeria vagabunda*, *Coryneum foliicolum*, *Fusarium mali*, *Alternaria grossulariae*, and other readily

identified species, a number of forms present were studied. These as technically described include the new genus and species *Polyopeus purpureus*, *P. pomi*, *P. recurvatus*, *P. aureus*; the new species *pleospora pomorum*, *Fuckelia botryoidea*, *Coniothyrium convolutum*, *Alternaria pomicola*, *Sclerotium stellatum*; and the new variety *C. cydoniae mali*.

Apple scab, C. W. MICHEL (*S. Dak. State Hort. Soc. Ann. Rpt.*, 17 (1920), pp. 31-37).—In this report and the discussion following it is stated that apple scab, due to *Venturia inequalis* (*Fusicladium dendriticum*), though quite similar to pear scab is not identical therewith. Apple scab causes in the United States annually a loss of almost \$50,000,000, and was unusually severe in South Dakota during the season of 1919. The loss in that State ranges from 1 to 10 per cent.

It is admitted that some conidia may overwinter on the apples but it is claimed that dead leaves are the main source of early infection. Spraying with lime sulphur (1 gal. of the concentrated solution, testing 32° Baumé, to 40 gal. water), to which should be added lead arsenate (1 lb. to each 50 gal. of the diluted lime sulphur), is at present the chief method of control.

A report of a cedar rust survey of Augusta County, Va., R. E. MARSHALL and F. D. FROMME (*S. Dak. State Hort. Soc. Ann. Rpt.*, 17 (1920), pp. 128-132).—The results are presented of a cedar rust survey conducted in Augusta County, Va., during the latter part of August, 1919, in an unusually favorable season for cedar rust infection, which was correspondingly severe.

York Imperial sustained the bulk of the losses, and the data presented are based on this variety. Orchards in the vicinity of very many cedars showed an infection percentage of 100, of many cedars 96 per cent, of few cedars 56 per cent, and of very few cedars 11 per cent. Defoliation percentages ranged usually from 18 to 48 per cent lower. Fruit yield varied inversely with the number of cedar trees in the vicinity, and the percentage of first-grade apples decreased very rapidly as infection increased. Records of actual cash losses were not obtained.

Cedar tree eradication [in West Virginia], W. E. RUMSEY (*W. Va. Dept. Agr. Bien. Rpt.*, 4 (1919-20), pp. 43-46, fig. 1).—Owing to the campaign (as here tabulated) against cedar trees in the principal apple-growing sections of the State, not much damage has recently been done to the apple crops by cedar rust.

Studies on the varietal resistance of the peach to artificial inoculations with *Gloeosporium laeticolor*, N. SUEMATSU and K. KUWATSUKA (*Ann. Phytopath. Soc. Japan*, 1 (1920), No. 3, pp. 1-12, fig. 1).—This report (with a short English bibliography) states that peach interests in Japan have been menaced for about 10 years by the presence of anthracnose (*G. laeticolor*), which has almost destroyed the peach crop over large areas, practically causing eradication of some of the earliest and most profitable varieties. Studies involving inoculation tests of 66 varieties indicated, while showing no case of complete immunity, bring out various degrees of susceptibility, 9 varieties being presented as specially resistant and 2 of these ripening quite early.

Experiments detailed appear to show that there is no biologic form among the strains of *G. laeticolor*. No adaptations were demonstrated. Chinese varieties are most resistant, while Persian varieties are usually susceptible.

The most important insect enemies and plant diseases attacking the leaves of currants and gooseberries (*S. Dak. State Hort. Soc. Ann. Rpt.*, 17 (1920), pp. 191-206, figs. 7).—Besides dealing with insect pests, this account includes such currant and gooseberry diseases as anthracnose (*Pseudopeziza ribis*), currant rust (*Cronartium ribicola*), two leaf spots (*Mycosphaerella grossulariae* and *Cercospora angulata*), and powdery mildew (*Sphaerotheca*

mors-uvae). Treatments are suggested in connection with each disease or insect, and a general spray is indicated for both insect and plant diseases on currant and gooseberry plants.

Late frost and olive scab, 1919, G. B. TRAVERSO (*Staz. Sper. Agr. Ital.*, 52 (1919), No. 10-12, pp. 463-484, figs. 7).—A defoliating branch disease, supposedly bacterial, is noted as occurring on olive during the summer of 1919 in parts of central and southern Italy. The disease is discussed as regards the causative organism and the differences between characters noted in the present attack and in previous attacks of what may be the same disease. Conditions supposedly favoring severity of attack are discussed.

Citrus blast and black pit, H. S. FAWCETT, W. T. HORNE, and A. F. CAMP (*Calif. Citrogr.*, 6 (1921), No. 7, p. 234, figs. 3).—The study briefly outlined is said to be confirmatory of statements previously published by Fawcett (*E. S. R.*, 43, p. 156).

The supposition that citrus blast and citrus black pit are caused by the same bacterium has been fully established by a large number of experiments. The organism is said to be the same as that named *Bacterium citriputeale* in 1913 by Smith (*E. S. R.*, 30, p. 652), and *B. citrarefaciens* in 1917 by Lee (*E. S. R.*, 37, p. 154). The disease is also identical with that described by Coit in 1916 (*E. S. R.*, 37, p. 153).

Previous to 1921, it was known that the lesions are more abundant on the south than on the north half of the tree, and on the long succulent shoots than on the short bushy compact growth. It was noted also that the blast was comparatively slight in sheltered situations and in years of light rainfall, becoming more abundant in long periods of moist, cool weather. Recent investigations have shown that blast starts almost invariably from lesions, particularly fresh injuries.

The question is discussed why the organism produces only the blast in southern California, but blast and black pit both in northern California.

Results of repeated trials indicate that Bordeaux mixture will lower the percentage of blast infections if applied early in autumn. Protection against wind injury, as by growing bushy trees, use of windbreaks to the south, or coating the surface with a fungicide, is suggested.

Citrus canker, E. M. EHRHORN (*Hawaii. Bd. Commrs. Agr. and Forestry [Bien.]*, Rpt., 1919-20, p. 84, pl. 1).—After the discovery of citrus canker (*Pseudomonas citri*) on the Kawahara property up Kalihi Valley, Honolulu, the infested trees were destroyed and a close watch was instituted. The disease does not seem to be so active here as in Florida. It has been found also on Kauai and may exist on Hawaii. It may have been present undetected for a long time, owing to its being easily mistaken for *Cladosporium citri*. Apparently no reason for alarm exists unless abundant rain causes a more rapid development of the disease.

A bacterial disease of the lily, U. BOKURA (*Ann. Phytopath. Soc. Japan*, 1 (1919), No. 2, pp. 36-90, pls. 2).—This is printed in the Japanese language.

A parasitic disease of strawberry tree, J. DUFRENOY (*Bul. Trimest. Soc. Mycol. France*, 34 (1918), No. 3-4, pp. 99, 100, fig. 1).—A leaf parasite of *Arbutus unedo* is supposed to be a Guignardia.

New species of Phomopsis parasitic on the Douglas fir, M. WILSON (*Bot. Soc. Edinb. Trans. and Proc.*, 28 (1919-20), pt. 1, pp. 47-49).—Branches and leaves of Douglas fir are attacked, in several localities named, by a fungus which affects the tree in two ways. The fungus, which is described as a new species under the name *P. pseudotsugae*, appears to be widely distributed in Scotland.

The damage to trees caused by Loranthuses and mistletoes, P. S. JIVANNA RAO (*Jour. Madras Agr. Students' Union*, 8 (1920), No. 6, pp. 157-161).—Species of *Loranthus* and *Viscum* are said to do considerable damage to some of the most valuable timber, fruit, and other trees. These are listed, with discussion regarding the nature of the losses and regarding eradication measures.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

A biological survey of Alabama, A. H. HOWELL (*U. S. Dept. Agr., Bur. Biol. Survey, North Amer. Fauna No. 45* (1921), pp. 88, pls. 11, figs. 10).—The first part of this work deals with the physiography and life zones (pp. 7-16) and the second part with the mammals of the State (pp. 17-76). A colored map of the life zones of Alabama, a bibliography of 42 titles, and an index are included.

South African mammals, A. HAAGNER (*London: H. F. & G. Witherby; Cape Town: T. Maskew Miller*, 1920, pp. XX+248, figs. 142).—This is a work intended for use by field naturalists, sportsmen, and travelers.

Territory in bird life, H. E. HOWARD (*London: John Murray*, 1920, pp. XIII+308, pls. 13).—This is a report of studies of the territorial dominion, discussed under the headings of the disposition to secure a territory, the disposition to defend the territory, the relation of song to the territory, the relation of the territory to the system of reproduction, the warfare between different species and its relation to the territory, and the relation of the territory to migration.

Birds of South Dakota, W. H. OVER and C. S. THOMS (*S. Dak. Geol. and Nat. Hist. Survey Bul. 9* (1921), pp. 142, pls. 21).—Part 1 of this work treats of the importance of bird study, bird habits, protection, etc. Part 2 consists of a list and descriptions of birds of South Dakota, and part 3 (pp. 140-142) of a bibliography.

Bird houses and nesting boxes, E. H. FORBUSH (*Mass. Dept. Agr. Circ. 10* (1920), 2. ed., rev., pp. 28, pls. 8, figs. 31).—This is a revised edition of the paper previously noted (*E. S. R.*, 34, p. 650).

[Report of the] division of entomology, F. P. JEPSON and C. H. KNOWLES (*Fiji Dept. Agr. Ann. Rpt. 1919*, pp. 7-14).—This report deals with insects injurious to fruit and vegetables, animals, books, etc., in Fiji, particularly studies of the banana borer (*Cosmopolites sordida*).

Beneficial fungi in citrus groves, A. T. SPEARE (*Citrus Indus.*, 2 (1921), No. 7, pp. 3, 4).

A method for studying the Hessian fly and other insects, J. W. MCCOLLOCH (*Ann. Ent. Soc. Amer.*, 14 (1921), No. 3, pp. 227-230, fig. 1).—The method here described is based upon the use of Pfeffer's solution in growing wheat plants in water. The plants can be handled conveniently and the various stages of the insect studied with greater ease and exactness than when the plants are grown in the soil. In this way the life history of the Hessian fly was readily followed from oviposition to the formation of the puparium. This method proved so successful in the Hessian fly work that it was adopted for the study of a number of other insects infesting cereal crops. Thus far the author has grown wheat, oats, rye, barley, corn, and many of the sorghums in Pfeffer's solution in connection with the study of the chinch bug, green bug (*Toxoptera graminum* Rond.), and corn leaf aphid (*Aphis maidis* Fitch).

The termites of South Africa, C. FULLER (*So. African Jour. Nat. Hist.*, 3 (1921), No. 1, pp. 14-52).—A preliminary account including a descriptive key to the genera and descriptions of the species. One subgenus and eight species are described as new.

Contributions toward a monograph of sucking lice, II, G. F. FERRIS (*Standford Univ. Pubs., Univ. Ser., Biol. Sci.*, 2 (1921), No. 2, pp. 53-133, figs. 57).—This second part of the work previously noted (E. S. R., 43, p. 452) deals with the genus *Hoplopleura*, of which 36 species and 8 subspecies are recognized, 21 species and 2 subspecies being described as new to science.

Potato leafhopper is found guilty, T. H. PARKS (*Ohio Farmer*, 148 (1921), No. 9, p. 8, figs. 2).—In the course of this account it is stated that demonstrations in Ohio have shown that Bordeaux mixture applied at intervals of two weeks during the growing season will give good results without the addition of nicotin sulphate.

The linear bug, *Phaenacantha australica* Kirkaldy: A new pest of sugar cane in Queensland, J. F. ILLINGWORTH (*Queensland Bur. Sugar Expt. Stas., Div. Ent. Bul.* 14 (1921), pp. 11, pls. 2).—This is a report of studies of a species that is gradually changing its habits, which are remarkably like those of the chinch bug, and is adapting itself to the ways of cultivation. Normally the bugs feed on the under surface of the leaves. It is said to be fairly well held in check by its natural enemies.

Biological studies of *Aphis rumicis* L. 1746, J. DAVIDSON (*Ann. Appl. Biol.*, 8 (1921), No. 1, pp. 51-65, fig. 1).—In this continuation of the author's studies (E. S. R., 32, p. 849), the transfer of infestation from *A. rumicis* to different plants, its reproduction on mangolds, sugar beet, etc., are reported upon. A general discussion of the influence of food plants on reproduction, the influence of food plants on the characters of the species, and the influence of temperature and humidity on the development of the species follows.

Biological studies of *Aphis rumicis* L., J. DAVIDSON (*Bul. Ent. Research*, 12 (1921), No. 1, pp. 81-89, figs. 6).—In this, the first of a series of papers based on breeding experiments and observations in the field, technical descriptions given of the several forms of this aphid are followed by an account of its life history. Its life cycle is graphically illustrated diagrammatically.

Spermatogenesis of aphids; the fate of the smaller secondary spermatocyte, H. HONDA (*Biol. Bul. Mar. Biol. Lab. Woods Hole*, 40 (1921), No. 6, pp. 349-368, pls. 4).—"In *Stomaphis yanois* the smaller secondary spermatocytes divide and develop to some extent, but retrogress to spherical cells. In *Neothomasia populicola* and *Macrosiphum ambrosiae* cases of division of the smaller secondary spermatocytes were found, but no developing smaller spermatids were observed. In *N. populicola* and *M. ambrosiae* spherical cells like those in *S. yanois* were found in the cysts containing spermatozoa. These were identified as retrogressed larger spermatids."

The citrus black fly (*Aleurocanthus woglumi* Ashb.), C. C. GOWDEY (*Jamaica Dept. Agr., Ent. Circ.* 3 (1921), pp. 11, pls. 2; *abs. in Agr. News [Barbados]*, 20 (1921), No. 509, pp. 346, 347).—This is a summary of information on *A. woglumi*, particularly as relates to its occurrence in Jamaica. Notes on its control by fungi, by the microbiologist, S. F. Ashby, are included (pp. 6-10). A report of studies of this pest by Dietz and Zetek has been noted (E. S. R., 44, p. 454).

A symbiotic fungus occurring in the fat body of *Pulvinaria innumerabilis* Rath., C. T. BRUES and R. W. GLASER (*Biol. Bul. Mar. Biol. Lab. Woods Hole*, 40 (1921), No. 6, pp. 299-324, pls. 3, figs. 2).—The fungus here considered belongs to *Dematium* or a related genus. The paper includes a bibliography of 28 titles.

An outline of the sericultural industry and sericultural labor in Japan (*Tokyo: Dept. Agr. and Com.*, 1921, pp. 16).—This paper includes a discussion of the present state of the sericultural industry in Japan, the kinds of sericul-

tural labor, the number of working days and hours and the nature of work, the wages of sericultural labors, etc.

Our common butterflies, F. E. LUTZ and F. E. WATSON (*Amer. Mus. Nat. Hist. Guide Leaflet* 38 (1920), 3. ed., pp. 31, figs. 42).—This is a brief illustrated account of butterflies, which includes a tabulation of their life histories.

The Hesperioidea of America north of Mexico, A. W. LINDSEY (*Iowa Univ. Studies Nat. Hist.*, 9 (1921), No. 4, pp. 114, pls. 2, figs. 31).—This is a generic revision and synopsis of the species.

Some factors in the natural control of the wattle bagworm, S. H. SKAIFE (*So. African Jour. Sci.*, 17 (1921), No. 3-4, 291-301, figs. 16).—This is a discussion of the predacious and natural enemies of *Acanthopsyche junodi* Heyl., studies of which pest by Hardenberg have been noted (E. S. R., 42, p. 360.) In the course of this work 59,637 bagworms were examined, of which about 1 per cent were destroyed by birds and rats, 19 per cent by insect parasites, 16 per cent by fungus diseases, and 17 per cent by other diseases, or a total of 53 per cent destroyed.

Parasites of the pale western cutworm in Alberta, E. H. STRICKLAND (*Canad. Ent.*, 53 (1921), No. 5, pp. 97-100).—This is an account of the parasitic enemies of *Porosagrotis orthogonia* Morr., which since 1911 has been the most destructive enemy of grain crops in southern Alberta and in a small area of southwestern Saskatchewan, its damage in some years having amounted to considerably over \$1,000,000. An account of this pest by Parker, Strand, and Seamans in Montana has been noted (E. S. R., 44, p. 757).

While its parasites appear to be absent from Montana, they are of great importance in Alberta. Two hymenopterous species mentioned are *Meteorus dimidiatus* Cress., parasitism by which increased from 2 per cent in 1914 to 10 per cent in 1919 and 50 per cent in 1920, and *Zele* sp., which was found in 1914 to parasitize 2 per cent of the larvae. Two tachinids of importance are *Gonia capitata* DeG., which parasitized 39 per cent in 1913, 43 per cent in 1914, 7.5 per cent in 1915, and about 5 per cent in 1919, and *Bonneto comta* Wied., which parasitized 2.5 per cent in 1913 and 11 per cent in 1915. Two other tachinids, *Peleteria robusta* Wied. and *Ernestia radicum* Fab., were reared in small numbers.

The fall army worm, *Laphygma frugiperda* (S. & A.), C. C. GOWDEY (*Jamaica Dept. Agr., Ent. Circ.* 4 (1921), pp. 4).—This is a brief summary of information on the fall army worm, of which there were extensive outbreaks in Jamaica in 1920, the outbreaks having been more serious and widespread than at any other time during the last decade.

The discovery of the European corn borer in southern Ontario, L. S. McLAIN (*Quebec Soc. Protect. Plants Ann. Rpt.*, 13 (1920-21), pp. 51-53).—This relates to the occurrence of *Pyrausta nubilalis* Hubn. in Ontario, information relating to which has been noted from another source (E. S. R., 44, p. 249).

The small leaf moth of coconuts in Fiji, *Levuana iridescens* Beth.-Bak., C. H. KNOWLES (*Fiji Dept. Agr. Bul.* 12 (1919), pp. 8, pl. 1).—The larvae of this moth feed on coconut leaflets and are a source of considerable injury on the Island of Vitilevu. Three other palms are found to be attacked by it, namely, the royal palm (*Oreodoxa regia*), the sago palm (*Sagus vitiensis*), and the areca nut (*Areca catechu*).

List of food plants of some South African lepidopterous larvae, E. E. PLATT (*So. African Jour. Nat. Hist.*, 3 (1921), No. 1, pp. 65-138).—This consists of a list of the plants with the larvae that feed on each, followed by a list of Lepidoptera arranged by families with the food plants upon which the larva of each feeds.

Mosquito breeding in saline waters, A. BALFOUR (*Bul. Ent. Research*, 12 (1921), No. 1, pp. 29-34).—A brief review of the subject with references to the literature.

The feeding habits of *Stegomyia calopus* Meig., R. M. GORDON and C. J. YOUNG (*Ann. Trop. Med. and Parasitol.*, 15 (1921), No. 3, pp. 265-268).—"S. *calopus* females will bite either by day or night over 14 days after their first blood meal while under no artificial restraint and having opportunities of selecting day or night for feeding."

The bionomics of *Tabanus aprepes*, and other Australian Tabanidae, G. F. HILL (*Bul. Ent. Research*, 12 (1921), No. 1, pp. 41-62, pls. 2, figs. 21).—In this paper the author describes in some detail the life history, habits, and developmental stages of *T. aprepes* Tayl. and *T. rufinotatus* Big., which were reared from egg to adult, and discusses the present status of knowledge of *T. nigritarsis* Tayl. and *Silvius notatus* Ric.

Attack of the fig in France by *Lonchaea aristella* Beck, R. POUTIERS (*Prog. Agr. et Vitic. (Ed. l'Est-Centre)*, 42 (1921), No. 38, pp. 285, 286).—The occurrence of this dipterous enemy of the fig in France is recorded for the first time. Studies of the pest by Silvestri in Italy have been noted (E. S. R., 41, p. 553).

Experiments in the control of the cabbage maggot (*Chortophila brassicae* Bouché) in 1920, W. H. BRITAIN (*Ent. Soc. Nova Scotia, Proc.*, No. 6 (1920), pp. 54-73, pl. 1).—This is a report of experiments conducted according to the same plan as those of the year 1919 (E. S. R., 43, p. 850; 45, p. 557). The details of the treatments given and the results secured, with an itemized account of the cost of the different treatments, are presented in tabular form.

The results in general correspond to those of the previous years. Corrosive sublimate, creosote clay, anthracene oil clay, and tar paper disks gave a perfect stand, while the tobacco corrosive sublimate clay mixture showed but a single casualty. There was a difference, however, in their relative position as regards yield, there being a marked difference in favor of the corrosive sublimate as compared with the crude creosote clay. It is suggested that in some indirect way the application of corrosive sublimate may have had a beneficial action upon the growth of the plant. The author notes that 1920 was the driest season in the history of the experiments, and that the mere watering of the plants in applying the material gave those thus treated a marked advantage. It is thought possible that the tar paper disks, which gave a net profit second only to corrosive sublimate, acted to some extent as a mulch, thus giving the treatment an advantage over the creosote clay. Creosote-clay dust sent to Ontario is reported by L. Caesar to have caused a serious burning or wilting of the plants.

In addition to results obtained on the continuation plats, experiments conducted on trial plats on a small scale (56 plants per plat), are reported upon, the details being presented in tabular form. The materials which gave the most promising results on these trial plats were corrosive sublimate, creosote, anthracene oil, pyridin, and derris. With the strength of corrosive sublimate reduced to two-thirds of that used in the continuation plats, there was still a perfect stand of cabbage, while with one-half the strength one cabbage only succumbed to maggot attack. Creosote used in greater strengths than that used in the continuation plats likewise gave a perfect stand, while one plant was destroyed with the weaker strength of anthracene oil. Pyridin with clay gave 100 per cent stand of sound plants, but with charcoal there was a loss of 7.14 per cent. Derris diluted to 50 per cent with clay or used as a liquid at the rate of 1.5 lbs. to 100 gals. of water also gave a perfect stand. A saturated solution of salt was found to be worthless.

A series of experiments conducted with a view to determining the exact time the material should be applied with relation to the emergence of the maggot are also reported upon in tabular form. The abnormal season and other conditions, taken in conjunction with the small number of plants available, made definite conclusions impossible. A few preliminary experiments to determine the stages of the insect that are susceptible to corrosive sublimate and derris are also reported upon.

Walnut husk maggot, F. E. BROOKS (*U. S. Dept. Agr. Bul. 992 (1921), pp. 8, pls. 4*).—The larvae of *Rhagoletis suavis* Loew attacks commonly the husks of the black walnut and the butternut, and has been reared by the author from the husks of the Persian or English walnut and the Japanese walnut. The species occurs quite generally over the natural ranges of the black walnut and butternut. In the present paper a preliminary account is given of the life history and habits of the species, of which there is but one generation annually.

The eggs are deposited in masses in punctures made in the husks at the time the nuts are approaching maturity, apparently none being deposited in the nuts after they drop. The adults begin to issue from the ground as early as the middle of July in the latitude of West Virginia, and appear to be present on the trees several weeks before oviposition begins. The eggs soon hatch, and the maggots rapidly convert the green tissue of the husk into black pulp, and, having attained full growth, enter the ground and pupate. In native black walnuts the eggs are deposited so late that the larvae do not prevent the nuts from maturing and dropping normally. In Persian walnuts, however, the eggs appear to be laid earlier in the development of the nuts, bearing trees having been observed in Maryland and Pennsylvania, a short time before the crop had ripened, on which a large percentage of the husks of the nuts were blackened throughout and the surface covered with a gummy exudation from the maggot injury within. Some of the infested Persian walnuts drop prematurely and others hang to the branches until after the sound nuts have fallen. In nuts that are attacked before maturing the development is arrested and the kernel becomes unfit for use. Thus the injury is threefold in that it impairs the quality of the kernel, causes the husk to stick to the shell in the hulling process, and blackens and soils the shell, making the nuts unattractive for market.

But one parasite of this maggot has thus far been observed, namely, *Aphaereta auripes* Prov., reared from the puparia by Babb at Amherst, Mass. In experimental control work conducted in Persian walnut groves in 1920, lead arsenate at the rate of 3 lbs. of paste to 50 gal. of water was applied by means of a power sprayer, on August 10, at New Windsor, Md. In a grove at West Willow, Pa., spraying was done, on August 9, with a hand sprayer mounted on a wheelbarrow, using 1.5 lbs. of lead arsenate powder to 50 gal. of water, and for several of the trees enough molasses was added to give a slightly sweetish taste to the liquid. The flies were found to be very numerous on the trees in the Pennsylvania grove for a period of a few days after the spray was applied and then decreased in numbers. Examinations and counts of the nuts of the sprayed trees in the Maryland grove just before the crop was gathered showed that 4 per cent of the nuts had been attacked by the maggots, whereas at least 60 per cent of the nuts had been destroyed by the maggots the previous year. In the Pennsylvania grove it was estimated that the condition was 75 per cent better than the year before, when no treatment was given.

The painted hickory borer (*Cyllene caryae* Gah.), E. H. DUSHAM (*New York Cornell Sta. Bul. 407 (1921), pp. 175-203, figs. 11*).—This is a summary of the present status of knowledge of the painted hickory borer, based upon a

review of the literature and investigations conducted by the author at Ithaca, N. Y.

The species was described and given the name *C. caryae* by Gahan in 1908, having been previously known as *Arhopalus*, *Clytus*, and *Cyllene*, *pictus*, by which name it was first described in 1863 by Drury and which was a synonym of *C. robiniae*. Its distribution is thought to be coextensive with the hickories, which are its main host plants. Its injury is caused mainly to the hickories, especially *Carya ovata*, but its work on osage orange is almost as injurious as on hickory. It has been reported as breeding in shagbark hickory, black walnut, pecan, butternut, mulberry, honey locust, osage orange, bitternut hickory, elm, wild grape, and hackberry. It is capable of causing considerable damage by attacking recently killed, standing trees, and felled timber, as well as unseasoned products from which the bark has not been removed. The author has never found it boring in such material after it has been dead for more than one year, although repeated attempts have been made to induce oviposition therein. It seems to prefer the smaller trees and branches to the large trunks, and in all cases the most severe injury is due to the pupal cells, which penetrate the larger trunks and branches to a depth of from 1 to 2 in., while in smaller branches they extend to the heartwood.

The adults emerge during May and June and sometimes during the first days of July, depending upon the season, and feed upon the pollen of *Crataegus* and probably that of other flowers. The eggs are deposited in crevices or under scales of the bark. These hatch in from 6 to 10 days, and the young larvae burrow through the bark. Here they drive their long, linear burrows with the grain of the wood, grooving the inner bark as well as the sapwood. They become full grown in from 10 to 12 weeks, at the end of which time a large oval-shaped hole is gnawed through the bark to the exterior and the construction of the pupal cell commenced. The pupal cell extends into the solid wood to a depth of 1 to 2.5 in., and then parallel with the grain of the wood for about 2 in. Upon the completion of this cell the larva retreats into it, plugs up the entrance with splinters and sawdust, and enters the prepupal stage, which lasts from 23 to 63 days. Transformation to pupae begins about the middle of September, and by November 12 all are in the pupal stage. Transformation to the adult beetles takes place in the spring.

The natural enemies of this pest include the larva of an elaterid beetle (*Hemirhipus fascicularis* Fab.), a nitidulid larva, and the parasites *Bracon erythrogaster* Br. and *Doryctes radiatus* Cr. *B. erythrogaster* appears to be quite effective in checking the borer.

Observations indicate that the adult is a sun-loving species and that material piled in the shade will not be attacked. It is recommended that standing dead timber be felled as soon as possible and utilized at once, or if this is impossible the logs should be barked or else put in water. Unbarked logs, posts, poles, and such material should never be left lying in the woods during the danger season, from May 1 to August 1. All material which can not be used, such as slashings, should be burned as soon as possible. It is pointed out that the destruction of *Crataegus* in the vicinity of large tracts of hickory would be beneficial, since it would destroy the food supply of the adult beetles at the time of emergence.

A bibliography of six pages is included.

The white grubs injuring sugar cane in Porto Rico.—II, The rhinoceros beetles. E. G. SMYTH (*Jour. Dept. Agr. Porto Rico*, 4 (1920), No. 2, pp. 31, figs. 9).—In this second part of the work previously noted (*E. S. R.*, 38, p. 161), which is edited by G. N. Wolcott, a general account is given of the biology of rhinoceros beetles of the genus *Strategus*, followed by detailed accounts of the

life history, habits, and means of control for the sugar-cane rhinoceros beetle (*S. titanus* Fab.) and the coconut rhinoceros beetle (*S. quadriveatus* Beauv.).

The life cycle of *S. titanus* was found to cover approximately one year. The minimum egg-to-adult period among the 44 reared adults was 271 days, and the maximum 429 days. The average normal egg-to-adult period for 44 individuals (of which 14 were male, 18 female, and 12 of undetermined sex) reared in tin boxes was 341 days, or practically 11.25 months. The other 0.75 month is about what is normally required as preoviposition period, that is, the time elapsing from emergence of the adult from the pupa to the laying of the first fertile egg. Control measures include the use of the proper method of planting cane, avoiding an excess of organic matter in the soil, and the use of a poison bait and of manure trap piles.

The life cycle of *S. quadriveatus* for two individuals reared from egg to adult was 430 days. "The preoviposition period was not determined, as neither of the two reared adults was kept alive for the egg. However, if the preoviposition period is the same as that for *S. titanus*, 24 days, this added to the egg-to-adult period of 430 days makes a total life cycle of 454 days, or 15 months. This is probably somewhat in excess of the average for the species." This species is of slight importance as a cane pest but is a real menace as a coconut pest, where control measures are necessary. These include collection of the beetles, removal of breeding places, and poisoning of the grubs.

Experiments in the treatment of balled earth about the roots of coniferous plants for the control of Japanese beetle larvae, B. R. LEACH and J. W. THOMSON (*Soil Sci.*, 12 (1921), No. 1, pp. 43-58, pls. 2).—This is a report of work conducted by the Bureau of Entomology, U. S. Department of Agriculture, at Riverton, N. J., in 1920.

Dipping tests indicate that certain compounds in solution, capable of producing a gas insoluble or only slightly soluble in water, are toxic to *Popillia japonica* grubs. These compounds are classed as (1) those slightly soluble in water, such as carbon disulphid, thymol, mustard oil, etc., and (2) those readily soluble in water such as sodium sulphocarbonate and sodium ethyl xanthate, which in solution on being decomposed by organic acids yield carbon disulphid, the active killing agent.

"Saturated solutions of compounds in class 1 (about 1 : 1,000) readily kill *Popillia* grubs when the latter are removed from the soil and dipped in the solution for a definite period of time. However, when *Popillia* grubs are embedded in a soil ball and the latter dipped in these solutions the grubs contained within the soil ball remain unharmed. Soil adsorption, or in other words physical 'locking up' of the compound in solution by the moisture film surrounding the minute soil particles, is the apparent reason for the failure of these relatively dilute solutions to function in soil. That portion of the compound adsorbed by the soil is apparently rendered impotent as far as its ability to produce grub mortality in the soil is concerned."

Compounds of the second class when used in dilute solutions give results comparable to those obtained from the first class. However, when compounds of the second class are employed in relatively concentrated solutions, a quantity of the compound sufficient to produce 100 per cent mortality remains free in the soil after the soil particles have adsorbed the compound to the limit of their capacity.

"The comparatively concentrated solutions of sodium sulphocarbonate and sodium ethyl xanthate, when used for the treatment of balled earth about the roots of coniferous plants for the control of Japanese beetle larvae injure the plants to an extent which prohibits the use of these compounds in practice."

Experiments with hot water in the treatment of balled earth about the roots of plants for the control of Japanese beetle larvae, B. R. LEACH (*Soil Sci.*, 12 (1921), No. 1, pp. 63-68, fig. 1).—This is a report of experiments conducted in connection with those above noted. They have shown that "the third-instar grubs of *Popillia japonica* withstand an exposure of 2 hours in water heated to a temperature of 105° F.; they succumb to an exposure of 45 minutes in water at a temperature of 110, to an exposure of 12 minutes at 115, to an exposure of 6 to 8 minutes at 120, to an exposure of 3 to 4 minutes at 125, and to an exposure of 1 to 2 minutes at 130°. When a bath of heated water (minimum temperature 110°) is used as a method of killing *Popillia* grubs in the balled earth about the roots of plants the soil ball must be immersed until brought up to a temperature of 110° and remain immersed at that temperature for a period of 45 minutes.

"The process of warming up the soil is necessarily slow because it is not safe to allow the temperature of the water bath to exceed 110° at any time. It requires 3 hours and 25 minutes to treat a soil ball 8 in. in diameter by this method. Under the circumstances and aside from the consideration of injury to the plant, the method is too slow to be utilized to any extent in practice. The results indicate that plants vary considerably in their resistance to immersion in heated water for various periods of time at various temperatures, but that even the more resistant plants are affected and checked in their subsequent growth."

A note on the susceptibility of woods to borer attack and on the value of rosin varnish as a protection, E. A. ANDREWS (*Indian Tea Assoc., Sci. Dept. Quart. Jour.*, 1921, No. 2, pp. 65-78).—The susceptibility of the wood of different trees to attack by shot borers of the family Bostrycidae and the results of protective treatment are reported upon.

Strigoderma arboricola Fab.—its life cycle (Scarab. Coleop.), W. P. HAYES (*Canad. Ent.*, 53 (1921), No. 6, pp. 121-125, figs. 8).—This is a report of studies at the Kansas Experiment Station, in which State *S. arboricola* is only at rare intervals sufficiently abundant to be of economic importance. In Kansas blossoms of wild and cultivated rose plants are apparently the preferred food of the beetles, and they have been observed to do considerable injury to roses in a nursery at Abilene, Kans. The larvae resemble the common white grubs.

"The beetles of *S. arboricola* occur during May, June, and July. Egg laying occurs in June and July. The eggs hatch in from 10 to 14 days, and the grubs pass the winter in the soil, requiring an average of 321.7 days to reach the prepupal condition, which in turn requires 4 to 8 days, making an average combined larval stage of 328 days. The prepupal stage varies in length from 11 to 14 days, with an average of 12.7 days." The individuals reared to maturity, with their egg stages added, required 351, 352, and 358 days for complete development."

Experiments on the destruction of Lasioderma serricorne Fab. by heat and with benzin, A. D'ANGREMOND (*Proefsta. Vorstenland. Tabak [Dutch East Indies], Meded.* 36 (1919), pp. 28, figs. 2).—A threatened shortage of carbon disulphid in the Dutch East Indies led to the experiments here reported, which have shown that a temperature of 50° C. (122° F.) continued for three hours is sufficient to destroy the larvae of the cigarette beetle, while a period of five hours is necessary to kill the eggs. It was found practically possible to kill the beetle even within the core of a bale of tobacco without injuring the packed tobacco by heating such a bale in a fermentation room at a temperature of from 55 to 60°. The use of 1.5 liters of benzin per cubic meter applied during a

period of four days is sufficient to kill the eggs, larvae, and adults, even within the core of the bale.

Two scolytids attacking fruit trees and their parasites, F. PICARD (*Soc. Path. Veg. France Bul.*, 8 (1921), No. 1, pp. 15-20).—This paper deals with *Scolytus rugulosus* Ratz. and *S. amygdali* Guer.

The life history and control of the pales weevil (*Hylobius pales* Herbst), H. B. PEIRSON (*Harvard Forest Bul.* 3 (1921), pp. 33, figs. 9).—The economic importance of this pest in its adult stage was first called to attention in 1914 by Carter (*E. S. R.*, 35, p. 747). The investigations here reported were commenced in September, 1919, and conducted almost entirely at the Harvard Forest at Petersham, Mass.

This weevil, which is a native of the United States, was first recorded as destructive by Wilson in 1840, again by Harris in 1852, and later by Packard, Felt, and others. Its distribution seems to be general throughout the eastern half of the United States and in southeastern Canada. Although in New England white pine is the most favored food, other trees must be fed upon over a large part of the area. *H. abietis*, a very similar species, occurs throughout Europe and has been considered one of the worst insect enemies the forester has had to deal with.

In their attack upon the tender bark of coniferous seedlings the adult beetles oftentimes entirely strip the bark from the stem and side branches, but the most characteristic injury is the removal of the bark in irregular areas, leaving numerous criss-cross ridges. These voracious feeders will kill a 3 or 4-year-old white pine seedling within a very few days, as many as 30 beetles having been found around the base of a single seedling. In New England it has long been observed that it is almost impossible to secure a reasonably pure stand of white pine reproduction promptly after the removal of older stands of pine, even though large numbers of seedlings may be present. This appears to be due to the fact that the beetles are attracted to areas where lumbering operations have been carried on, such as the felling of trees and the sawing and stacking of lumber, or to areas where trees have been destroyed in such a manner that the odor of pitch or sap is still apparent. The investigations show that damage occurs the first three years after cutting white pine, 98 per cent occurring the first two years, and after the third year no new injury is done. The experiments show that freshly sawed lumber and freshly cut slash and pine logs will attract the beetles to the vicinity even when carried a long distance from the cutting.

The known food plants listed include five species of *Pinus*; two of *Larix*; two of *Picea*; one each of *Abies*, *Tsuga*, *Pseudotsuga*, and *Thuja*; and two of *Juniperus*; also the gray birch and white ash. The species appears to be a strong flier, and its habits of migrating are responsible for its great economic importance.

The adults emerge from hibernation from the latter part of April to the latter part of May, depending upon climatic conditions, and remain in the immediate vicinity until the middle of June, when they swarm to some locality where, preferably, a white pine logging operation has just taken place. Upon reaching new breeding grounds they may feed from one to two weeks on the pine chips, slash, or even on the bark of pine logs, if no suitable seedlings are present. Eggs are then laid, usually singly, either in freshly cut pine logs or in the roots of freshly cut pine stumps. The eggs hatch in from 10 days to 2 weeks and the larvæ begin burrowing beneath the bark, where they feed for nearly two months before reaching maturity. About September 1 the larvæ pupate beneath the bark in individual cells, penetrating about 0.25 in. into the

sapwood and covered over with frass. They remain in this stage until about October 1, although some adults may emerge as early as September 15. Upon emerging the adults feed upon the nearest pine seedlings, and it is at this time that the most severe damage is done. The beetles have been observed feeding as late as November 18 in the vicinity of Petersham, Mass., and as late as December 1 in an outdoor cage at Boston, Mass., where the difference in altitude is about 1,000 ft. The winter is spent for the most part in the soil at the base of the seedlings upon which the beetles have been feeding.

Technical descriptions are given of its several stages. A brief reference is made to similar species, *Pissodes strobi* being the one most liable to be confused with the pales weevil.

The relation of the general behavior of the beetle to control is considered. It has a few natural enemies, of which the fungus *Sporotrichum globuliferum* appears to be the most important. Control measures, considered under the headings of control on cut-over pine lands and control on open land, depend upon methods of handling pine stands, an account of which by Fisher and Terry has been noted (E. S. R., 43, p. 149). The so-called shelter wood method has resulted in a reproduction of pine varying from 3,000 to 25,000 seedlings per acre.

The life history of *Euthyrhinus meditaundus* Fab., an important weevil pest of mango trees in Australia, G. F. HILL (*Bul. Ent. Research*, 12 (1921), No. 1, pp. 63-66, pl. 1, fig. 1).—This is a report of studies of *E. meditaundus* at Townsville, in north Queensland, where mango trees are often killed by its attacks upon the trunks and branches.

Heat production of honeybees in winter, R. D. MILNER and G. S. DEMUTH (*U. S. Dept. Agr. Bul.* 988 (1921), pp. 18, figs. 4).—This is a report of further investigations (E. S. R., 31, p. 254), in which a small colony on four combs having natural honey stores were placed in the chamber of a small respiration calorimeter and their carbon-dioxid production and oxygen consumption measured for 10 days, while the temperature of the air surrounding the bees was kept just low enough so that the bees at all times would remain clustered.

"There were 14 thermocouples distributed in the hive in the calorimeter in such manner that the temperatures in different places inside and outside the cluster could be ascertained, the leads from the thermocouples being extended through the outlet in the wall of the chamber to a potentiometer on the outside. The temperatures were read every half hour, day and night, for nearly 12 days. . . .

"Under these circumstances, rarely found in the apiary, the energy produced by the bees, as measured by the carbon dioxid and water produced and the oxygen consumed, was greater, according to body weight, than that produced by a man when working at hard manual labor, when we take into consideration the fact that the work was done by only a relatively few of the bees in the cluster."

Beekeeping in Canada, F. W. L. SLADEN (*Canada Expt. Farms Exhibition Circ.* 18 (1920), rev., pp. 4, figs. 2).—A brief account which includes a list of the equipment necessary in making a start in beekeeping.

The honeybee and beekeeping, F. GERSTUNG (*Der Bien und Seine Zucht. Berlin: Fritz Pfenningstorff*, 1921, 6. ed., rev. and enl., pp. VIII+527, pls. 32, figs. 293).—This is a handbook on apiculture.

The Thomas Say species of Ichneumonidae, R. A. CUSHMAN and A. B. GAHAN (*Ent. Soc. Wash. Proc.*, 23 (1921), No. 7, pp. 153-171).

A new species of the chalcidid genus *Zatropis* (Hym.), J. C. CRAWFORD (*Ent. Soc. Wash. Proc.*, 23 (1921), No. 7, pp. 171, 172).—*Z. tortricidis*, reared from *Polychrosis viteana* at North East, Pa., is described as new.

Studies on the biology and control of chiggers, H. E. EWING (*U. S. Dept. Agr. Bul.* 986 (1921), pp. 19, figs. 4).—This is a preliminary account of the life history and bionomics of chiggers occurring in this country and means for their control, based upon a review of the literature and investigations conducted during 1919 and 1920. The author recognizes two forms, neither of which represent *Leptus americanus* or *L. irritans*. His systematic studies have led to the conclusions (1) that *L. americanus* is not a species of Trombididae, but rather a species of the family Erythraeidae, a group to which the genus *Leptus* really belongs and (2) that *L. irritans* is the larva of species of Trombididae, but since the characters given by Riley are not even of generic value, the species it represents can not be determined. There is apparently a single chigger species occurring in New Jersey, Maryland, the District of Columbia, Virginia, and southeastern Iowa and a second very closely related species in the northern and western part of the United States.

Experiments by the author indicate that the larvae do not dig in as has been frequently stated but remain attached externally, the thickness of the skin being of great importance in localizing chigger attachment. The author's observations indicate that field mice do not serve as a host for the chigger as they do in Japan, as reported by Kitashima and Miyajima (*E. S. R.*, 41, p. 753). The natural host of the American chigger still remains to be determined.

It is pointed out that much protection can be had by properly clothing the lower extremities, or by the application of repellents, such as sulphur, either directly to the skin or to the undergarments. Much can be accomplished by clearing fields of underbrush which serves as breeding places for the chiggers.

An account of chiggers by Chittenden in 1915 has been noted (*E. S. R.*, 33, p. 258).

A second Nearctic species of Protura, *Acerentulus barberi* n. sp., H. E. EWING (*Ent. News*, 32 (1921), No. 8, pp. 239-241).

FOODS—HUMAN NUTRITION.

Principles of general physiology, W. M. BAYLISS (*London and New York: Longmans, Greene Co.*, 1920, 3. ed., rev., pp. XXVI+862, figs. 261).—The chief addition to the third edition of this well-known book (*E. S. R.*, 42, p. 658) is a section on the capillary circulation.

Chemical factors in nutrition, L. B. MENDEL (*Jour. Franklin Inst.*, 192 (1921), No. 1, pp. 1-10).—A general discussion of recent advances in the chemistry of nutrition.

Quality of protein in nutrition, R. H. A. PLIMMER (*Nature [London]*, 107 (1921), No. 2699, pp. 664-668, figs. 4).—This is a general discussion, with numerous references to the literature, of the qualitative differences in proteins and their bearing on problems of nutrition.

The relative value of the proteins in nutrition, R. H. A. PLIMMER (*Jour. Soc. Chem. Indus.*, 40 (1921), No. 12, pp. 227R-229R; also in *Amer. Jour. Pharm.*, 93 (1921), No. 9, pp. 645-652).—Essentially noted above.

Fat minimum, M. HINDHEDE (*Skand. Arch. Physiol.*, 39 (1920), pp. 78-131).—Following a brief review of the early vitamin work of Osborne and Mendel, McCollum, and Hopkins, the author presents the detailed reports of metabolism experiments covering a period of 16 months with two subjects on fat-free diets.

On diets of bread and potatoes with rhubarb or apples, the subjects were able to maintain a positive nitrogen balance and to keep in good physical condition. On a diet of barley groats and sugar, the nitrogen balance became negative and a loss in appetite and body weight followed. The author at-

tributes the success of the first ration to the presence of vitamins in the fresh vegetables and fruits, and concludes that in experiments which have tended to show the necessity of fat in the diet it has been a question of the fat-soluble vitamin and not the fat itself.

The accessory food factors.—I, The peculiar nutritive value of various edible fats, H. ARON and R. GRALKA (*Biochem. Ztschr.*, 115 (1921), No. 3-6, pp. 188-203, figs. 6).—This paper, while presenting nothing new from the standpoint of vitamins, is of interest in the acceptance by the authors, as a result of the experimental work reported, of the belief that fats in themselves are not indispensable constituents of the diet, and that the importance attributed to such fats as butter, egg yolk fat, and cod liver oil is due to their content in fat-soluble vitamin.

The vitamin manual, W. H. EDDY (*Baltimore: Williams & Wilkins Co.*, 1921, pp. 121, figs. 9).—This book has been called a manual on account of the emphasis that has been placed on laboratory methods for vitamin testing to which two chapters are devoted. The other six chapters include an historical development of the discovery and attempts to determine the chemical nature of vitamins, tabulations of the sources of vitamins, a discussion of their chemical properties and utilization, and a final chapter on deficiency diseases.

Vitamins essential factors in nutrition, A. J. J. VANDEVELDE (*Over Vitaminen of Bijkomende Factoren van de Voeding*. [Ghent: Author, 1920], pp. 10).—A brief review of the literature.

Vitamins and the food supply, A. HARDEN (*Jour. Soc. Chem. Indus.*, 40 (1921), No. 5, pp. 79R-82R).—A comprehensive summary of present-day knowledge concerning vitamin requirements and the variations in the vitamin content of natural and prepared food materials.

Three-cornered meals, C. L. HUNT (*Pictorial Rev.*, 22 (1921), No. 8, p. 36, figs. 3).—A presentation in popular form of the essential facts about vitamins, with suggestions for various food combinations to include the three vitamins or the "A-B-C diet."

Feeding experiments in connection with vitamins A and B: (1) The value of steam-distilled palm kernel oil as a control fat; (2) wheat bran as a source of vitamins A and B, A. D. STAMMERS (*Biochem. Jour.*, 15 (1921), No. 4, pp. 489-493, figs. 2).—Feeding experiments with rats are reported from which the conclusion is drawn that palm kernel oil steam-distilled for three or four hours at a temperature of 230 to 260° C. is entirely deprived of vitamin A, and that ordinary bran contains an appreciable amount of vitamin A and adequate amounts of vitamin B when given in 2-gm. daily doses.

Vitamins and cod liver oil, J. LANG (*Schweiz. Apoth. Ztg.*, 59 (1921), No. 38, pp. 501-504).—A brief discussion of the properties of vitamin A, with special reference to the question of the refining of cod liver oil.

The vitamin doctrine and the oleomargarin industry, W. D. RICHARDSON (*Inst. Margarin Manfrs. Proc.*, 2 (1921), pp. 11-26; also in *Amer. Food Jour.*, 16 (1921), No. 7, pp. 27-32).—In this article, which is essentially a plea for the use of oleomargarin instead of butter, the author bases his argument largely on the occurrence of vitamin A in other articles of food than dairy products and on the possible waste involved in the conversion of milk into butter through failure to utilize the buttermilk.

Present status of nutrition and its relation to food manufacture, V. K. LA MER (*Amer. Food Jour.*, 16 (1921), No. 7, pp. 7-10).—This is the first of a series of papers in which the scientific knowledge now available on nutritive values of food is briefly reviewed and discussed, with particular reference to food manufacture. The present paper deals with recent changes in the nature

of food supplies, followed by a brief discussion of the significance in nutrition of proteins and mineral elements.

The present status of nutrition, V. K. LA MER (*Amer. Food Jour.*, 16 (1921), Nos. 8, pp. 15, 16; 10, pp. 31, 32).—These two papers continue the series noted above, the first discussing briefly the fat-soluble A vitamin and recent discoveries regarding this accessory food factor, and the second the water-soluble vitamin B.

Some recent contributions to the literature of vitamins, II, III, L. M. POTTER (*Internatl. Jour. Pub. Health*, 1 (1920), Nos. 2, pp. 240-247; 3, pp. 367-371).—The first of these two papers reviews the literature on beriberi, including a discussion of recent papers in which other theories than vitamin deficiency are presented in explanation of the cause of beriberi. It is shown, however, that the other etiological factors suggested appear to be rather predisposing than causative. A list of 41 references to the literature is appended.

In the second paper the fat-soluble vitamin is discussed, particularly from the viewpoint of a connection between lack of this vitamin and rickets. A list of 28 references to the literature is appended.

Fat-soluble vitamin.—VIII, The fat-soluble vitamin content of peas in relation to their pigmentation, H. STEENBOCK, M. T. SELL, and P. W. BOUTWELL (*Jour. Biol. Chem.*, 47 (1921), No. 2, pp. 303-308, figs. 2).—To test further the theory of a biological relationship between vitamin A and yellow pigmentation, three samples of ripe yellow peas and three of ripe green peas were compared as to relative pigment content and as to content in vitamin A by the technique described in previous publications (E. S.^{*}R., 46, p. 61). The green peas were found to be much richer in yellow pigment than the yellow varieties, and were also found to be far richer in their vitamin A content. That even yellow peas are not to be classed with seeds of very low vitamin A concentration such as wheat, oats, and barley was shown by the appreciable growth during the first two months on the experimental ration containing 15 per cent of peas as the sole source of vitamin A, and by the still better growth when the amount of peas was increased to 50 per cent of the ration. In the three groups of four animals each, which were fed green peas at a 15 per cent level, growth was satisfactory for at least four months and only one case of incipient ophthalmia and one of respiratory infection occurred.

The need of further investigation of the effect of commercial and household processes on the vitamin content of foods, J. R. MURLIN (*Jour. Home Econ.*, 13 (1921), No. 9, pp. 389-395).—A summary and digest of data.

Preliminary report on the effect of cooking foods in the pressure cooker on the biological value of such foods, L. STANLEY and R. WHIPPLE (*Jour. Home Econ.*, 13 (1921), No. 9, pp. 446, 447).—While the authors do not feel that conclusions can be drawn from data obtained up to the present time, the results would seem to indicate that foods cooked in a pressure cooker for the time and pressure recorded are, as measured by experiments with white rats, less efficient biologically than when raw.

Use of the pressure cooker in the home, M. C. DENTON (*Jour. Home Econ.*, 13 (1921), No. 8, pp. 361-366).—The changes which take place in foods cooked in a pressure cooker and characteristics of foods so cooked, some precautions which should be observed, the possibility of the use of the pressure cooker for different kinds of food, and similar problems are discussed.

"The pressure cooker then, is best suited to the cooking of tough meats, many cereal preparations (not most batters and doughs), dried legumes, and vegetables of mild flavor."

The pressure cooker can also be used "for the extraction of fruit juices for the making of jelly by ordinary methods, provided that pains be taken not to overcook the fruit and thus injure the pectin. In case of very hard fruit or vegetable tissues, extraction in the pressure cooker may sometimes result in a richer juice, which will produce a larger yield of jelly, than when the fruit is cooked at the boiling point."

Some experience is needed, however, and directions can not be given offhand.

The cooking of green vegetables (*Jour. Home Econ.*, 13 (1921), No. 8, pp. 372, 373).—A digest and discussion of data.

Apples and [vegetable] marrows, M. B. I. (*Table and Housekeepers' Jour.*, 70 (1921), No. 1804, p. 152).—A number of recipes are given for the use of vegetable marrow as substituted for a part of the apple ordinarily used in making pies and a number of other dishes. This is regarded as an economy when apples are high in price.

Jellied grapefruit peel or orange peel, F. W. YEATMAN (*Jour. Home Econ.*, 13 (1921), No. 8, pp. 366, 367).—As a result of comparative studies directions are given for making jellied peel. The method described gives a tender, jelly-like and translucent product.

The dietetic value of sugar, W. D. HORNE (*La. Planter*, 67 (1921), No. 14, pp. 222, 223; also in *Facts About Sugar*, 13 (1921), No. 14, pp. 263, 269).—This argument for the greater consumption of sugar is based upon the fact that more energy can be obtained for a given amount of money from sugar than from almost any other foodstuff. The significance of other essential dietetic factors than energy is not taken into consideration.

Report of experiments on the cold storage of herrings carried out at North Shields (June and July, 1919), I. H. GREEN (*Jour. Hyg. [Cambridge]*, 19 (1920), No. 1, pp. 75-83).—A preliminary study of comparative methods of treating herrings in cold storage is reported with the following conclusions:

At 18° F. brine freezing is more satisfactory than dry freezing both for gutted and ungutted fish. The keeping qualities of ungutted frozen fish are superior to those of the gutted ones. If herrings are to be gutted, it is cleaner and more practical to gut them before freezing. A plea is given for more cleanly methods in the handling and packing of herrings.

Condensed milk, P. LASSABLIÈRE (*Le Lait Condensé. Paris: A. Maloine & Son*, 1920, 2. ed., pp. [3]+VII+151).—Essentially a reprint of the first edition (E. S. R., 45, p. 862).

Emulsification in mayonnaise, K. L. MARK (*Jour. Home Econ.*, 13 (1921), No. 9, p. 447).—A progress report.

Shortening: Its definition and measurement, C. E. DAVIS (*Jour. Indus. and Engin. Chem.*, 13 (1921), No. 9, pp. 797-799, figs. 5).—An apparatus which will measure the shortening value of different oils and fats in terms of breaking and crushing strength is described and illustrated, and the results are reported of tests of the shortening powers of various fats when incorporated in sugar cookies prepared under carefully standardized conditions. Shortening is defined by the author as follows:

"That cake which requires the least load to measure its breaking strength is the shortest; that which requires the heaviest load is the least short. The best shortening is that material which when baked in a dough gives to the product a minimum breaking strength and a minimum crushing strength."

Lard was found to be the best shortening agent tested under these conditions. Oils partially hydrogenated were better shortening agents than the nonhydrogenated oils.

A further application of the apparatus suggested is its use in the classification of flours by means of the breaking strength of standard products in which the flour is the only variable substance.

Experiments in the making of doughnuts of low fat absorption, M. C. DENTON and L. B. PRITCHETT (*Jour. Home Econ.*, 13 (1921), Nos. 6, pp. 255-260; 7, pp. 309-316).—Many experiments conducted under standardized conditions and reported in detail indicate that a stiff dough (large proportion of flour) absorbs less fat than a soft dough. Cooked riced potato added to the dough decreases the tendency of the mixture to absorb fat, and "gluten when 'developed' or partially fused by kneading is more effective than when it exists in separate particles in a lightly mixed dough." Overhandling is, however, scarcely to be recommended if one wishes a doughnut of pleasing texture. Other factors useful in reducing the amount of fat absorbed by a mixture are (a) the cooking of the flour or flour and cornstarch before frying, as is done in making queen fritters; (b) allowing the dough to stand and "ripen," sometimes as long as overnight; (c) reduction of the time of frying by raising the temperature of the fat or by submerging the doughnuts during the frying, as is done in the home by means of a wire frying basket; and (d) use of yeast instead of baking powder as a leavening agent.

Factors influencing the nutritive value of lard and lard substitutes, J. C. DRUMMOND (*Jour. Soc. Chem. Indus.*, 40 (1921), No. 8, pp. 81T-86T).—This paper is based chiefly on the researches of the author on the vitamin content of lard and lard substitutes which have been previously noted (*E. S. R.*, 45, p. 566).

Strictly exogenous substances necessary to the animal organism, A. CAMPUS (*Riv. Biol.*, 3 (1921), No. 4, pp. 497-513).—The substances which are required by the animal organism for growth and maintenance are classified as strictly exogenous and facultatively exogenous, the first group including those indispensable substances which can not be synthesized by the organism, and the second equally indispensable substances which need not be introduced into the organism as such but can be synthesized from simpler materials. The recent literature on the strictly exogenous food materials, including the elements chlorin, calcium, iron, and phosphorus; the amino acids cystin, tryptophan and lysin, and arginin and histidin; cholesterin; and the vitamins, is reviewed in this paper.

The importance of minerals in the diet, A. W. SANDWALL (*Mass. Dept. Pub. Health [Pamphlet]*, 1921, pp. 7).—This leaflet contains lists of foods rich in calcium, iron, and phosphorus, with a brief description of the importance of these elements in nutrition.

The distribution of calcium and phosphoric acid in the blood of normal children, M. R. JONES and L. L. NYE (*Jour. Biol. Chem.*, 47 (1921), No. 2, pp. 321-331).—The distribution of calcium and the various compounds of phosphoric acid in the blood of 34 normal children whose ages range from 4 weeks to 14 years has been determined, using Lyman's method (*E. S. R.*, 37, p. 207) for calcium and Bloor's method (*E. S. R.*, 40, p. 16) for phosphorus, each with slight modifications.

The average calcium content of the corpuscles was found to be slightly less than that of the plasma, the values in milligrams per 100 cc. being 9.4 for whole blood, 8.7 for corpuscles, and 10.0 for plasma. Neither age (within the above limits) nor sex appeared to be a factor in the calcium concentration of the blood or its distribution between plasma and corpuscles.

The blood corpuscles proved richer in all types of phosphoric acid compounds than the plasma. The amount of unknown phosphoric acid, as described by

Bloor (E. S. R., 40, p. 176), in the plasma was negligible, while in the corpuscles it averaged approximately 70 per cent of the total. In general the values for boys averaged slightly higher than those for girls, this being specially true of the lipid phosphoric acid content of the corpuscles which averaged 65.7 mg. per 100 cc. for boys and 55.8 mg. for girls. The inorganic phosphoric acid content of the corpuscles, while showing a greater percentage variation than that of any other phosphorus compound, averaged lower in both boys and girls (average 12.1 and 10.3, respectively) than the figures reported by Bloor for adults, 18.7 for men and 15.7 for women. The total phosphoric acid content of the plasma varied from 33 to 48 mg. in boys, with an average of 41.1, while in girls the range was from 27 to 47 mg., with an average of 36 as compared with Bloor's values of 32 for men and 36.2 for women. The lipid phosphoric acid content of the plasma averaged 32 mg. for boys and 27.7 for girls. The inorganic phosphoric acid averaged 9.8 for boys and 8.8 for girls.

No relation between the alkali reserve and the concentration of calcium and phosphoric acid in the blood could be established.

Biochemical studies on marine organisms.—II, The occurrence of zinc, M. BODANSKY (*Jour. Biol. Chem.*, 44 (1920), No. 2, pp. 399-407).—Continuing the biochemical studies of marine organisms previously noted (E. S. R., 44, p. 556), determinations of zinc were made on 20 species of marine animals by the turbidimetric method of Birckner (E. S. R., 41, p. 464).

Zinc was found in every species analyzed, the amounts varying from 2.5 mg. per kilogram in mullet to as high as 341 mg. in a sample of shucked oysters. A further study of the distribution of zinc in various parts of the oyster showed a rather uniform content in the digestive organs, mantle, and gills, with a lower content in the muscles. On dialysis of finely ground oysters for 96 hours, 49.5 per cent of the zinc was recovered in the dialysate. It is thought that the zinc may be present in excess of its combining power with the proteins of the tissue, or may exist in part in a loosely combined state which is disintegrated during dialysis.

The dietitian's duties in a State institution, T. CLOW ([*Ill.*] *Inst. Quart.*, 12 (1921), No. 1-2, pp. 73-76).—Dietitian studies are discussed, and information regarding the work of dietitians in Illinois institutions is given.

"So far the greatest emphasis has been placed upon securing a proper basic dietary." After consultation with various food experts, a standard dietary was adopted for the State hospitals which is now being tried out, and it is hoped that at least it will furnish the patients with the food necessary for proper nutrition.

[Basal metabolism] (*Jour. Amer. Med. Assoc.*, 77 (1921), Nos. 4, pp. 247-255, figs. 2; 5, pp. 347-357, figs. 14).—The following papers represent a symposium on basal metabolism held at the annual meeting of the American Medical Association in Boston in June, 1921: The Measurement and Standards of Basal Metabolism, by F. G. Benedict; Fundamental Ideas Regarding Basal Metabolism, by G. Lusk; The Basal Metabolic Rate in Hyperthyroidism by W. M. Boothby; Determination of the Basal Metabolism as a Method of Diagnosis and as a Guide to Treatment, by J. H. Means; and The Basal Metabolism in Fever, by E. F. Du Bois.

Basal metabolism and its clinical measurement, H. G. EARLE and J. S. GOODALL (*Lancet* [London], 1921, I, No. 17, pp. 853, 854).—This is a brief description of the Benedict portable respiration apparatus, together with a summary of the criticisms of the apparatus by Boothby and Sandiford (E. S. R., 45, p. 670), their objections being given to illustrate the precautions that must be taken in using this apparatus. In the opinion of the author, the prin-

principal objection to the use of the present form of the apparatus is the one described by Boothby and Sandiford as the error introduced by failing either to start or to stop the experimental period at exactly the end of a normal respiration. To overcome this error, the authors have devised a kymographic attachment, using glazed paper and a pen, which furnishes a permanent record of the whole test.

Standards of basal metabolism in normal infants and children, F. B. TALBOT (*Amer. Jour. Diseases Children*, 21 (1921), No. 6, pp. 519-528, figs. 14).—This paper presents in a concise form the basal metabolism curves for infancy and childhood, as obtained in the studies of Benedict and Talbot previously noted (*E. S. R.*, 45, p. 561), together with a brief discussion of factors leading to variations from the average in certain groups of apparently normal children.

Studies of infant feeding.—XIII, The caseins of cow's milk and human milk in their relation to infant feeding. The action of rennin on casein, A. W. BOSWORTH (*Amer. Jour. Diseases Children*, 22 (1921), No. 2, pp. 193-201).—Samples of casein prepared from cow's milk by the method of Van Slyke and Bosworth (*E. S. R.*, 29, p. 9) and from human milk by the method of Bosworth and Giblin (*E. S. R.*, 39, p. 668) have been compared as to chemical properties with a view to explaining the differences in the action of rennin on the two types of casein. These are attributed largely to differences in the inorganic constituents of cow's and human milk. The caseins of both forms are considered to be acids of the same chemical composition and characteristics, the two caseins forming the same series of salts with bases. In cow's milk the casein is present as a calcium caseinate, while in human milk it is probably present as potassium caseinate.

Coagulation of the casein by rennin is promoted by soluble casein salts and retarded or inhibited by soluble sodium, potassium, and ammonium salts. As human milk contains small amounts of casein and soluble calcium with relatively large amounts of sodium and potassium, and cow's milk or any of its modifications contains large amounts of casein and soluble calcium with relatively small amounts of sodium and potassium, the tendency of rennin under suitable conditions is to cause no curdling or the production of only a small amount of very finely divided curds in the former and large flocculent curds in the latter. As the curd formation requires the development of acidity in the milk, it is emphasized that all milk used for infant feeding should be pasteurized immediately after milking.

Acrodynia: Its place in medicine and its relation to pellagra, E. J. WOOD (*Amer. Jour. Trop. Med.*, 1 (1921), No. 5, pp. 291-310).—The author traces the descriptions in the literature of acrodynia and pellagra, and suggests the probability that the two diseases are identical. If this be true, it becomes possible to trace pellagra to a much earlier period (1735) than the introduction of Indian corn or maize into Europe.

Scurvy in the World War, A. F. HESS (*Internatl. Jour. Pub. Health*, 1 (1920), No. 3, pp. 302-307).—A brief review of the literature.

The antiscorbutic properties of concentrated fruit juices, IV, A. HARDEN and R. ROBISON (*Biochem. Jour.*, 15 (1921), No. 4, pp. 521, 522).—Dried orange juice, which has been reported to retain its antiscorbutic properties for two years at room temperature (*E. S. R.*, 43, p. 460), has been found to lose about 50 per cent of its antiscorbutic value after storage for 14 months in a dry atmosphere at 29° C. (84.2° F.).

Defective diet as a cause of sterility.—A study based on feeding experiments with rats, E. REYNOLDS and D. MACOMBER (*Jour. Amer. Med. Assoc.*, 77 (1921), No. 3, pp. 169-175, figs. 11).—This is a provisional report of an experi-

mental study of the production of infertility in rats by partial dietary deprivation of essential substances, together with clinical observations of human infertility comparable to those of the experimental work.

Albino rats of a strain which had a standard mating fertility of 65 per cent on the stock diet employed were subjected to incomplete diets low, respectively, in vitamin A, calcium, proteins, and both calcium and proteins. The first three diets reduced the mating fertilities of the rats from the normal, 65 per cent, to 55, 31, and 14 per cent, respectively. Rats brought to maturity on the double deficiency diet were of small size and poor condition, and all matings proved sterile.

Some suggestions concerning the bacteriological diagnosis of human botulism, K. F. MEYER and J. C. GEIGER (*Pub. Health Rpts.* [U. S.], 36 (1921), No. 23, pp. 1313-1317; also in *Amer. Food Jour.*, 16 (1921), No. 8, pp. 29, 30).—The authors report the isolation of *Bacillus botulinus*, type B, from the jejunal wall of a case of botulism fatal on the fifth day of the disease, and also the isolation of *B. botulinus*, type A, from stool specimens of two clinical cases of botulism from two different outbreaks. In one case the organism was found on the sixth and seventh day after the consumption of the causative meal and in the other case on the eleventh day. The importance of culturing the stools and tissues of all clinical cases of botulism is emphasized.

The difficulty in making differential diagnosis between encephalitis lethargica and botulism, J. C. GEIGER (*Pub. Health Rpts.* [U. S.], 36 (1921), No. 29, pp. 1663-1665).—The author reports the isolation by Burke and Dickson of *Bacillus botulinus* from the brain culture of a fatal case which had been diagnosed as encephalitis lethargica. This is mentioned as an illustration of the difficulty of proper differentiation between encephalitis lethargica and botulism. A few distinguishing features of the two diseases are summarized.

Direct inoculation test for *Bacillus botulinus* toxin, I. A. BENGTSON (*Pub. Health Rpts.* [U. S.], 36 (1921), No. 29, pp. 1665-1671).—Experimental evidence is presented that the intraperitoneal inoculation of mice or guinea pigs with suspected foods is a useful method for quick determination of the toxin of *B. botulinus* in foods and for determining the type of organism present. Three series of animals should be inoculated, one with culture alone, one after previous inoculation with type A antitoxin, and one after previous inoculation with type B antitoxin. Mice are considered more favorable than guinea pigs for carrying out the test.

An investigation into the purity of American strains of *Bacillus botulinus*, G. F. REDDISH (*Jour. Infect. Diseases*, 29 (1921), No. 2, pp. 120-131).—From 18 out of 19 so-called strains of *B. botulinus*, the author has isolated nontoxic strains which have proved to be *B. sporogenes*. The presence of this organism as a contaminant of the American strains of *B. botulinus* is thought to account for the differences in properties between the American strains and the descriptions of *B. botulinus* given by Van Ermengem and other European investigators. It is thought that the sources from which American strains of *B. botulinus* have been obtained have been such that close association of this organism with *B. sporogenes* must be taken as a matter of fact. The use of such impure cultures in the making of serum is thought to account for the absence of uniformity of results in the treatment of botulism.

ANIMAL PRODUCTION.

Studies in the dynamics of histogenesis, IV-VI, VII, E. J. CAREY (*Amer. Jour. Anat.*, 29 (1921), Nos. 1, pp. 93-115, figs. 9; 3, pp. 341-377, figs. 20).—The first of these two papers is a study of the development of the hind limb in the

embryonic pig and is divided into three chapter headings intended to continue a series of papers previously noted (E. S. R., 44, pp. 264, 265). The subtitles are (4) Tension of Differential Growth as a Stimulus to Myogenesis in the Limb, (5) Compression between the Accelerated Growth Centers of the Segmental Skeleton as a Stimulus to Joint Formation, and (6) Resistances to Skeletal Growth as Stimuli to Chondrogenesis and Osteogenesis. It is concluded "that the various stages of the developing skeleton are resultants of the mechanical resistances to growth, which, interpreted, means that cartilage and bone are not self-differentiated nor are they spontaneously self-crystallized products, but they are the immediate cellular responses to the varying intensity of the stresses and strains produced by resistances (pressure) counteracting the growth of the blastemal skeleton."

In the experiment reported in the second paper (No. VII), Tension of Differential Growth as a Stimulus to Myogenesis, a silver tube was permanently affixed in the walls of the bladder of a young dog, connecting the cavity of the organ with the exterior. At frequent intervals for a period of eight weeks concentrated boric acid was forced into the bladder, thus increasing the internal pressure greatly until the fluid could be discharged through the urethra. As a result the smooth muscle of the bladder wall was converted into a cross striated muscle resembling heart muscle in histological structure and manifesting a similar rhythmical contraction. It is concluded, therefore, that in respect to muscular tissue function determines structure and not the reverse.

Studies on the structure and multiplication of bone cells facilitated by a new technique, T. H. BAST (*Amer. Jour. Anat.*, 29 (1921), No. 2, pp. 139-157, figs. 6).—A method of making whole mounts of thin lamina and splinters of bone is described which avoids the distortions associated with the usual acid treatment. The procedure consists of fixing in 95 per cent alcohol, washing in water, staining in gentian violet, dehydration, clearing in benzol, thorough scraping of the specimen while immersed in benzol to remove all traces of the periosteum, and finally mounting in balsam. The presence of the periosteum during staining causes the matrix to remain colorless, while the bone cells become deeply stained. A study of such preparations of the turbinates, ethmoids, and parietal bones of young laboratory animals showed clearly the cytoplasmic granulation of the bone cells, the protoplasmic processes and their anastomosis, the centrosomes, the absence of canalicular spaces, the form and structure of the nucleus, and the rapid division of the nucleus, which was always by amitosis.

Various types of amitosis in bone cells, T. H. BAST (*Amer. Jour. Anat.*, 29 (1921), No. 3, pp. 321-339, figs. 14).—This is a more detailed study of amitosis in bone cells as seen in preparations made by the author's method, noted above.

It is concluded that amitosis is the exclusive method of bone cell multiplication. Two distinct types are recognized: (1) In which the nucleus is dumb-bell shaped with the centrosomes at the opposite poles of the nucleus; and (2) in which the nucleus is horseshoe-shaped with the centrosomes lying close together between the two arms. A study of the literature showed a third type of amitosis in which the plane of cleavage is indicated by a plate-like structure and the centrosome is absent or functionless. Eight different views as to the occurrence and significance of amitosis in animal tissues were found in the literature.

Further evidence concerning the function of osteoclasts, H. E. JORDAN (*Anat. Rec.*, 20 (1921), No. 3, pp. 281-294, pl. 1, figs. 2).—In the course of a histological study of the bone marrow in the new-born cat, the author found that the multinucleated giant cells contain large globules of resorbed osseous

material, and concludes, contrary to the views of Arey (E. S. R., 44, p. 363), that they are true osteoclasts and have a definite osteolytic function.

The causes of whiteness in hair and feathers, R. M. STRONG (*Science*, n. ser., 54 (1921), No. 1398, p. 356).—On the basis of extensive observations the author states that unpigmented hairs and feathers appear white because of the dispersion of light by the numerous internal reflecting surfaces and not, as claimed by W. D. Bancroft and others, because of the entrance of air into the structure.

Studies on the effects of thirst, I, II, T. KUDO (*Amer. Jour. Anat.*, 28 (1921), No. 2, pp. 399-430; *Jour. Expt. Zool.*, 33 (1921), No. 2, pp. 435-461).—In these two papers the author reports the weights of the individual organs of albino rats used in experiments in which the water supply was greatly reduced.

I. Effects of thirst on the weights of the various organs and systems of adult albino rats.—In the acute thirst series the rats were fed on dry feed only for from 6 to 16 days. This resulted in an average loss of 36.1 per cent of the gross weight of the 8 experimental rats. The thymus, spleen, parotid glands, pancreas, submaxillary glands, lungs, and liver showed a percentage loss in weight greater than that of the body as a whole. In the musculature, heart, thyroid, kidneys, skeleton, and a number of glands, the proportionate loss was less than in the entire body, while in the case of the nervous system there was a slight increase in the weight.

In a series of chronic thirst experiments in which the amount of water was reduced for from 47 to 55 days there was a more gradual loss of weight, but owing to the greater length of the periods the total loss was greater, averaging 52.4 per cent of the body weight. In general the organs were affected in the same way as in the acute thirst experiments except that there was a proportionately greater loss in the musculature, and the nervous system did not gain in weight.

II. Effects of thirst upon the growth of the body and of the various organs in young albino rats.—In the experiments reported month-old rats were held at constant body weight for several weeks by restricting the amount of liquid in a diet otherwise adequate for growth. The rats showed a progressive tolerance of thirst so that less liquid was required for maintenance as the experiments proceeded. In these rats the tail became elongated and there was a marked increase in the weight of the skeleton. The visceral organs tended to increase slightly in weight, the musculature remained nearly constant, and the integument and a number of the glands suffered a loss.

The effects of inanition in the pregnant albino rat, with special reference to the changes in the relative weights of the various parts, systems, and organs of the offspring, L. W. BARRY (*Carnegie Inst. Wash. Pub.* 274 (1920), pp. 91-136).—The author records the weights of various internal organs in 60 newborn young produced by female rats underfed during the last half of pregnancy, together with similar data from 10 newborn young and 29 fetuses from normally fed rats.

There was no constant relation between the percentage loss in weight of the starved mothers and the weight of the newborn, but in general the largest females showed the largest relative loss in weight and bore the largest young. The young from the starved mothers were characterized by long tails and an increase in the relative size of the head and limbs. The viscera as a whole averaged 18 per cent below the weight in the control fetuses from normally fed females, due mainly to a pronounced reduction in the weight of the liver and lungs. The dried skeleton averaged about 12 per cent and the integument 10 per cent above the same controls. The spleen, eyeballs, epididymides, testes, and brain manifested a strong growth tendency despite the inanition of the mothers.

Starvation during the second half of gestation resulted in an average gestation period of 23 days, or 1 day above the normal. No abortions were observed in any of the underfed rats, and on an average there were 5.9 young to a litter, which appears to be slightly below the normal.

The effects of acute and chronic inanition upon the development and structure of the testis in the albino rat, D. M. SIPERSTEIN (*Anat. Rec.*, 20 (1921), No. 4, pp. 355-391, figs. 5).—In 2-day-old rats starved for from 48 to 50 hours, the author found that the testis increased markedly in weight, but the number of mitoses was reduced and histological differentiation was arrested. In rats 3 weeks old, underfed for varying periods, mitosis continued in the seminiferous tubules, but spermatogenesis did not proceed beyond the first spermatocyte. This stage persisted even to the age of 400 days, with the formation of new spermatocytes and the degeneration and absorption of the old. The spermatogonia and Sertoli cells were not affected by underfeeding except in extreme cases. Acute inanition in adult rats sufficient to cause a loss in body weight of from 40 to 37 per cent was almost without effect on the structure of the testis except in a few isolated tubules.

Refeeding, after prolonged inanition extending to upwards of 20 weeks, resulted in the case of young rats in a rapid return to the normal histological structure. Spermatogenesis was resumed and spermatozoa appeared in 37 days. There was a definite hypertrophy of the interstitial tissue during recovery, but during inanition and starvation the interstitial tissue retained its normal structure in practically all cases.

On the changes in the reproductive organs in heterosexual parabiosis of albino rats, N. YATSU (*Anat. Rec.*, 21 (1921), No. 2, pp. 217-228, figs. 7).—Stimulated by Lillie's theory as to the origin of freemartins, the author performed a number of experiments in which a male and a female white rat were joined by a surgical operation so that a joint blood circulation was established. There were 24 successful cases of the union of a normal male and normal female, and 14 of the union of a castrated male and a normal female. The rats ranged in age from 29 to 90 days at the time of the operation, and the union persisted for various periods up to 179 days.

When the male was not castrated the ovaries and uterus of the female partner developed normally, with the formation of some Graafian follicles and corpora lutea. On the other hand, when a castrated male was used the follicles did not develop normally, no corpora lutea were formed, follicular cysts became abundant, and there was a marked growth of the interstitial cells among which a few lutein cells appeared. There were profound changes also in the structure of the uterus, which became edematous. The testes and prostrate glands were not influenced by the union with a normal female. In one case where a normal male and a spayed female were joined sperm formation was delayed.

The author is unable to account for the influence of castration on the reproductive organs of the female partner.

On the physiological properties of the gonads as controllers of somatic and physical characteristics, III, IV, C. R. MOORE (*Jour. Expt. Zool.*, 33 (1921), Nos. 1, pp. 129-171, figs. 15; 2, pp. 365-389, figs. 4).—Two papers are presented in continuation of this series (E. S. R., 42, p. 767).

III. *Artificial hermaphroditism in rats.*—This is a report of 14 successful cases in which a white rat with one of its gonads removed served as a host for a rat gonad of the opposite sex. The transplanted gonads grew and persisted for periods of over eight months. In the case of the transplanted ovary the Graafian follicles differentiated normally up to the period of maturation, when

the follicles underwent atresia instead of ovulation, and the follicular masses were converted into interstitial cells. In the transplanted testes no spermatozoa were formed, but the seminiferous tubules, containing only Sertoli cells, were well formed.

IV. *Gonad transplantation in the guinea pig*.—Guinea pig ovaries implanted in young castrated male guinea pigs continued to grow and retained the characteristic appearance of ovarian tissue for several months. The teats of the mammary glands of the host became as enlarged as in a pregnant female, but no other female characteristics were acquired by the male. In cases where testes grafts persisted in the female, spermatogenesis continued for a period and there was a modification of the external genitalia of the female in the male direction.

The author finds no indication of an antagonistic action of the secretions of the gonads of the opposite sex as claimed by Steinach.

Contributions to the morphology of the female sex organs in mammals.—On the appearance of corpora lutea in the ovaries of domestic cattle and swine, M. KÜPPER (*Vrtljschr. Naturf. Gesell. Zürich*, 65 (1920), No. 1-2, pp. 377-433, pls. 3).—The author has studied the external appearance of a large number of ovaries of the cow and the sow and records the numbers of Graafian follicles and corpora lutea in different stages. Materials were secured from slaughterhouses, but it was usually known when the animals had been in heat last.

In both species a definite ovarian cycle was observed. The corpora lutea increase in size during the first half of the period between ovulations and then if pregnancy has not ensued decline again. The period of retrogression extends through more than one estrual cycle, each resulting in a new crop of corpora lutea. In pregnant sows there were always more corpora lutea of pregnancy than embryos, the average ratio being 1.6:1. This is thought to be a characteristic of all multiparous animals. In the cow the number of corpora lutea of pregnancy was equal to the number of fetuses.

On the minimum of testicular substance necessary for the normal formation of sex characters, A. LIPSCHÜTZ, B. OTTOW, and K. WAGNER (*Pflüger's Arch. Physiol.*, 188 (1921), No. 1-3, pp. 76-86).—A series of experiments with castrated and partially castrated guinea pigs are reported which show that about 1 per cent of the normal testicular mass is sufficient for full development of all male characters, and that less than 0.5 per cent is sufficient to prevent the appearance of the characteristics of a castrated male. Histological changes in the minute pieces of testicular tissue remaining in the partially castrated animals resembled those observed by other investigators in cryptorchid and transplanted testes, in testes exposed to X-rays, and as a sequel to the ligature of the ductus deferentia, namely, the cessation of spermatogenesis and a simple epithelium lining the seminiferous tubules.

If the interstitial cells are the important endocrine tissue of the testes, it is pointed out, only about 1 per cent of the actual secretion is necessary. If the Sertoli cells are the important source of the internal secretion, then from 6 to 18 per cent of the normal secretion is sufficient, and finally, if the sperm-forming cells elaborate the internal secretion, the merest trace has the same end result as that produced by the whole mass.

Sexual neutralization obtained by means of orchilytic and ovariolytic sera, R. GUILIANI (*Ann. Ig. [Rome]*, 30 (1920), No. 6, pp. 323-326).—In the author's experiments five rabbits were injected systematically with serum from a goat sensitized to testicular tissue of rabbits. Two of the rabbits succumbed at the outset, and the others were killed after 15, 30, and 40 days of the serum treatment. The testes of the latter showed progressive atrophy

involving absence of germ cells and almost complete disappearance of the seminiferous tubules. The author considers his procedure a valuable substitute for castration. Experiments with ovariolytic sera are not reported.

Studies on the physiology of reproduction in birds, IX-XII, O. RIDDLE ET AL. (*Amer. Jour. Physiol.*, 57 (1921), No. 2, pp. 228-290).—These four papers continue the earlier ones of this series previously noted (E. S. R., 40, p. 664).

IX. *On the relation of stale sperm to fertility and sex in ring doves*, O. Riddle and E. H. Behre (pp. 228-249).—In the experiment reported each pair of ring doves was kept in a separate pen. For a day or two after the laying of a clutch of eggs the pair were kept together, and then the male was confined in a small cage within the larger one. Fertile eggs were laid by the hens for as long as 8 days following the isolation of the male. Since the eggs are fertilized more than 24 hours before they are laid, it is concluded that the spermatozoa may retain their fertilizing power for 7 days. No evidence was secured that the stale spermatozoa influenced the sex ratio of the offspring or caused the death of the embryos.

X. *Inadequate egg-shells and the early death of embryos in the egg*, O. Riddle (pp. 250-263).—A number of the female ring doves used in the investigation noted above habitually produced eggs with very thin shells and a high proportion of their eggs failed to hatch. The shell defect is attributed largely to the fact that the doves had been made to produce eggs at an abnormally rapid rate. The deaths of the embryos is thought not to be due to the soft shells as such, but to a more fundamental cause responsible for both conditions.

XI. *Effects of feeding soluble calcium salts upon reproductive secretions and upon the total inorganic constituents of the egg-shell*, O. Riddle and M. C. E. Hanke (pp. 264-274).—A mixture of calcium lactate and calcium lactophosphate was fed to 10 ring doves laying thin-shelled eggs, in doses of from 0.113 to 0.452 gm. per head daily. The dry shell substance was not increased and was perhaps slightly diminished by the added calcium in the feed. The amount of albumin secreted was measurably decreased, but there was no change in the rate of egg laying. It is concluded that the production of thin-shelled eggs and the associated death of the embryos are not caused by an inadequate calcium supply.

XII. *The relation of nerve stimuli to oviducal secretions as indicated by effects of atropin and other alkaloids*, O. Riddle and C. V. King (pp. 275-290).—Alkaloidal preparations in varying doses were administered to female ring doves at periods when eggs were in the oviducts. Subcutaneous injections of cocain decreased the amount of shell material by about 5 per cent, and the feeding of pilocarpin hydrochlorid increased it slightly. Albumin secretion was reduced somewhat under the influence of cocain and when atropin sulphate was fed, but seems to have been increased slightly by pilocarpin feeding. Injections of nicotin appeared to be without effect on the activities of the shell gland and the albumin gland.

"If the innervation of the oviduct is similar to that of the mammalian uterus, and the alkaloids used by us have an action on the autonomic nerves of birds similar to their action in mammals, these results supply some evidence that the oviducal secretions of birds occur largely independently of the nervous system. The small effects observed are possibly ascribable to the direct action of the drugs on the secreting cells, or to more general action on the metabolism of the animal."

The logos of the hereditary process, V. HENSEN and P. HARZER (*Pflüger's Arch. Physiol.*, 188 (1921), No. 1-3, pp. 98-113).—This is a discussion of the chromosomes in relation to the independence and the segregation of hereditary

characters, and includes a mathematical note on the probability of specific chromosomes or hereditary units being paired at segregation.

The analysis of the results of Professor Johannes Schmidt's diallel crossings with trout, H. L. THRAUGHTENBERG (*Jour. Genetics*, 11 (1921), No. 1, pp. 75-78).—Considering Schmidt's solution (E. S. R., 43, p. 866) of the problem of estimating the generative value of a parent with respect to a given character from a knowledge of the expression of this character in the offspring, the author suggests a modification in which the assignment of an arbitrary generative value to one of the parents is avoided by regarding the personal value of each parent as an approximation to its generative value. The generative values are determined by the method of least squares from the personal values of the parents, which are given unit weights, and the equations of Schmidt (concerning the average of each set of offspring with the means of the generative values of the two parents) which are given a weight equal to the square root of the number of offspring.

Racial investigations.—VI, Statistical investigations on inheritance in *Zoarces viviparus* L., K. SMITH (*Compt. Rend. Lab. Carlsberg*, 14 (1921), No. 11, pp. 61, figs. 6).—This study of variation and mother-offspring correlation in a viviparous fish is noted because the author develops the mathematical theory of Schmidt's method of distinguishing between personal and generative values through diallel crossing (E. S. R., 43, p. 866) by showing that an estimate can be made of the variation in the generative values even though they themselves can not be determined owing to absence of information concerning the male parents. It is thus possible to study the relative importance of generative values and environmental influences in producing variations in the personal or observed values.

Methods of analysis of pedigrees with respect to inbreeding and relationship, T. ELLINGER (*Nord. Jordbrugsforsk.*, 1921, No. 2, pp. 49-66, figs. 3).—This is an exposition of the use of Pearl's coefficients of inbreeding and relationship, together with the modifications suggested by the author (E. S. R., 45, p. 671).

Data concerning linkage in mice, W. L. WACHTER (*Amer. Nat.*, 55 (1921), No. 640, pp. 412-420).—Breeding experiments with mice at the Bussey Institution are reported which indicate that agouti is not linked to piebald spotting or to black-eye-white spotting, and that the latter is not linked to pink eye.

Short ears an autosomal mutation in the house mouse, C. J. LYNCH (*Amer. Nat.*, 55 (1921), No. 640, pp. 421-426, fig. 1).—The author describes a short-eared mutant of the house mouse showing well defined characters readily distinguished from the normal type. Breeding experiments at the Rockefeller Institute indicated that the mutant character is recessive to long ears and is due to a single gene not sex-linked.

A new mutation in the house mouse, J. A. DETLEFSEN (*Amer. Nat.*, 55 (1921), No. 640, pp. 469-473).—A color mutation in the house mouse is described. The hairs are almost white when the animal is young, but become brownish later, particularly on the back, but without showing any trace of the agouti hair patterns. Breeding tests at the Illinois Experiment Station indicated that the gene responsible forms with the genes for albino and for normal intense color a set of three allelomorphs, being dominant to the former and recessive to the latter.

Inheritance of belting spotting in cattle and swine, G. B. DURHAM (*Amer. Nat.*, 55 (1921), No. 640, pp. 476, 477).—From a review of published investigations of inheritance in Dutch Belted cattle and Hampshire swine, the author concludes that the belted pattern represents the heterozygote between self and the ordinary white spotting.

Silage: Theoretical and practical study of silage and its adaptability for Argentina, J. M. SCASSO (*Ensilaje: Estudio Teórico-Práctico del Ensilaje y de su Adaptación a la Argentina*. Buenos Aires: Min. Agr. Nac., 1920, pp. 419, figs. 53).—This treatise covers various aspects of silage making, including the value of silage as a feeding stuff in comparison with fresh and dried forage, the chemical and bacteriological changes taking place in the silo, the various plants which are of value in silage making, the construction of silos, the cost of silage making, and the feeding of silage. An appendix gives replies to a questionnaire sent to various users of silos in Argentina.

Some considerations concerning silage, P. LAVENIR (*Rev. Zootéc.*, 8 (1921), No. 96, pp. 361-372).—This article on the composition and nutritive value of silage includes analyses by A. Chaudet and E. Tello of silages made of alfalfa, corn, and oats grown in Argentina.

Sunflower silage, F. T. SHUTT (*Canada Expt. Farms, Seasonable Hints, East. and B. C. Ed.*, No. 20 (1921), pp. 3, 4).—Proximate analyses are tabulated of samples of sunflower silage produced in various localities in Manitoba, Saskatchewan, Alberta, and Ontario.

Quality in sunflower silage, M. J. BLISH (*Montana Sta. Circ.* 96 (1921), pp. 7).—This is a popular discussion of results set forth in Bulletin 141 (E. S. R., 45, p. 871).

Beef production in the Corn Belt, W. H. BLACK (*U. S. Dept. Agr., Farmers' Bul.* 1218 (1921), pp. 34, figs. 14).—This consists of suggestions for producing, buying, and fattening feeder steers in the Corn Belt and replaces Farmers' Bulletin 588 (E. S. R., 31, p. 468). Besides suggested rations and summaries of experiment station tests, the section on fattening includes data secured in a survey of feeding practices in Indiana, Illinois, Iowa, Nebraska, and Missouri showing the proportion of different feeds consumed by steers in each State and an estimate of the number of cattle fed, the total feed consumption, the feed per unit gain, and the cost of gain.

Wintering and summer fattening of steers in North Carolina, R. S. CURTIS, F. T. PEDEN, and F. W. FARLEY (*North Carolina Sta. Bul.* 243 (1921), pp. 3-20, figs. 4).—This material has been noted from Bulletin 954, U. S. Department of Agriculture (E. S. R., 45, p. 469).

Distribution of live stock in North America, L. THOMPSON (*Bul. Pan Amer. Union*, 53 (1921), No. 2, pp. 109-124, figs. 10).—This is a discussion of the relation of the live stock industries of South America to topography and rainfall, and includes maps showing the distribution of cattle, sheep, goats, and swine.

Sheep, goats, llamas, and alpacas are found chiefly in the semiarid regions. Sheep-growing tends to occur in the more temperate parts and goat farming in tropical and subtropical areas, with llamas and alpacas important in cool regions where owing to scanty pasture sheep do not thrive. Cattle and swine are numerous in fairly moist warm regions and generally occur in the same areas. However, in the heavily stocked cattle region around the Plata River swine are not numerous, although large quantities of corn are grown. Elsewhere the distribution of swine is similar to that of corn.

A Mendelian experiment with Aberdeen-Angus and West Highland cattle, J. A. S. WATSON (*Jour. Genetics*, 11 (1921), No. 1, pp. 59-67, pl. 1).—The author reports observations on the F_1 and F_2 generations of a cross between Aberdeen-Angus bulls and West Highland and Highland \times Chartley cows. The F_1 consisted of 1 male and 6 female calves completely polled and 1 male bearing short horns. The F_2 generation was derived from the latter bull and

consisted of 2 polled males, 15 polled females, 4 horned males, 3 horned females, and 1 male with loose scurs. The high incidence of horns among the males is explained by assuming that the polled character is incompletely dominant in the male.

The original Highland cows varied in color and included dark reds, reddish duns and yellow duns. The duns seemed to be dominant to the black of the Angus and the latter dominant to red. The possibility of dun being produced by a dominant dilution factor is pointed out.

Observations on Japanese Bovidae, K. IGUCHI (*Jour. Col. Agr. Hokkaido Imp. Univ.*, 9 (1921), No. 5, pp. 261-300, pls. 6).—Continuing his earlier studies on bovine craniometry (*E. S. R.*, 40, p. 276), the author adds descriptions of the external characteristics of various Japanese types and an extensive series of body measurements. In cranial characters and body form the Japanese cattle are found to be distinct from the European breeds, but show resemblance to Eastern Asiatic types. It is concluded, therefore, that the native cattle are not indigenous but have wandered across Chosen from North China.

Sheep breeding experiments (*Scot. Bd. Agr. Rpt.*, 9 (1920), p. LIV).—This is a brief note of experiments undertaken by the Board of Agriculture for Scotland.

It has been found that crossing Shetland ewes with Kerryhill rams resulted in lambs superior in size and vigor to the Shetlands. The fleece of the cross-breeds was doubled in weight, while the quality of the wool was equal to that of pure Shetlands. An attempt to improve the wool of Blackface sheep by means of Southdown rams is under way.

Studies on the Mendelian inheritance of the important racial characteristics of Karakul sheep in pure breeding and in crossing with Rambouillets, L. ADAMETZ (*Studien über die Mendelsche Vererbung der Wichtigsten Rassenmerkmale der Karakulschafe bei Reinzucht und Kreuzung mit Rambouillets*.—Leipzig: Borntraeger Bros., 1917, pp. VII+258, pls. 16).—In this publication, the first volume of the *Bibliotheca Genetica* edited by E. Baur, the author reports observations on Karakul sheep breeding in Bokhara, and gives the results of extensive breeding experiments in Austria in which crosses were made between different varieties of Karakuls and the imported stocks were crossed with Rambouillets and native sheep. The volume consists of eight papers as follows:

I. *On the method of inheritance of the Karakul curl in crosses between Bokhara fat-tailed sheep and Rambouillets* (pp. 1-42).—Essentially noted from another source (*E. S. R.*, 38, p. 575).

II. *Investigations of the inheritance of hair color within the Karakul breed of sheep* (pp. 42-77).—Besides the ordinary Karakul (Arabi type), which is a deep black until the age of 3 or 4 years, the author also used in his experiments the Shiraz type, which may be brown or gray. The fleece of the gray variety is a compound of colored and white hairs resembling a roan, and the author was informed that gray rams are never used as breeders. The black was found to be dominant to brown and the gray dominant to the other two. To explain the breeding results the author postulates four genes, *A* for black hair color, *E* a restricting factor producing white, *C* a factor for the mixing of colored and white hairs, and *D* a factor which increases the number of black hairs in the fleece. In addition a factor *B* is postulated for brown, although no cases were found where this was absent.

III. *Investigations of the inheritance of hair coloring in crosses of Karakul sheep with Rambouillets* (pp. 77-123).—The Rambouillet is considered a pigmentless breed as far as the wool is concerned. In the cross with the Karakul,

the F_1 were all black or brown, but whites reappeared in the F_2 . The experimental results are explained by postulating a factor F which in the absence of A inhibits pigment formation. The Rambouillets used in the experiment were homozygous for F . Some of the Karakuls were heterozygous, but were not white since they also carried A .

IV. *Investigations of the inheritance of drooping ear in Karakul-Rambouillet crosses* (pp. 123-150).—The drooping of the ear, which is characteristic of the Karakul sheep, tended to be dominant in the F_1 generation and to segregate in a 1:2:1 ratio in the F_2 . However, there was much variation in the amount of drooping in the F_1 s.

V. *On the Mendelian inheritance of ear length in crosses of Karakul sheep with Rambouillets* (pp. 151-165).—The ears of the Karakul rams used in the experiment varied from 12 to 14.75 cm. in length, and of the Rambouillet ewes from 8.5 to 9.5 cm. Ear length was incompletely dominant in the first generation and there was considerable variation, the range extending from 10.5 to 14.3 cm. The results are explained on Lang's theory of polymeres (multiple factors).

VI. *On the Mendelian inheritance of white markings in Karakul sheep and in Karakul-Rambouillet crosses* (pp. 165-205).—The markings considered are the white spots appearing on the forehead and the tip of the tail, and sometimes on the feet. Of the 27 F_1 lambs in the Karakul-Rambouillet crosses 22 showed white points. The author assumes two factors, G for freedom from white markings and H for their expression in the absence of G . The markings are not manifested in the Rambouillets owing to the pigmentless condition of the hair and skin.

VII. *On the Mendelian inheritance of fat tails in Karakul-Rambouillet crosses* (pp. 205-226).—The fat-tail characteristic of the Karakul was found to be strongly dominant and to be manifested in newborn F_1 lambs by an empty skin pouch. The experimental results are interpreted on the basis of two duplicate genes, J_1 and J_2 .

VIII. *On the Mendelian inheritance of curvature of the vertebral column of the tail in Karakul-Rambouillet crosses* (pp. 227-254).—In the experiments reported, the S-shaped tail of the Karakul tended to be dominant to the straight tail of the Rambouillet, although some of the F_1 s showed approximately normal tails. The variation in the expression of the S-shaped tail character in the crossbred is interpreted on the basis of Lang's theory of polymeres.

Barley v. corn for fattening hogs, N. K. CARNES (*Duroc Digest*, 5 (1921), No. 12, p. 27).—A lot of 11 125-lb. pigs fed by the free choice system at the Minnesota Experiment Station for six weeks beginning May 25, 1921, required 4.06 lbs. of ground barley and 0.47 lb. of tankage per pound of gain, and made an average daily gain of 1.5 lbs. per head. The check lot required 3.32 lbs. of shelled corn and 0.38 lb. of tankage per pound of gain, and gained at the rate of 1.87 lbs. per head daily.

Vitamin studies.—VII, *The influence of fresh alfalfa upon the weight of testes in Single Comb White Leghorn cockerels*, R. A. DUTCHER and S. D. WILKINS (*Amer. Jour. Physiol.*, 57 (1921), No. 3, pp. 437-443).—Continuing this series of studies from the Minnesota Experiment Station (E. S. R., 45, p. 165), the authors report an experiment with White Leghorn cockerels.

The right testes were removed from five cockerels after 37 days' feeding on polished rice exclusively and were found to average 0.16 gm. in weight, while the right testes of a similar group fed rice and green alfalfa averaged 1.19 gm. The feeds were reversed during a subsequent feeding period of 46 days, after which the birds were completely caponized. The average weight of the

left testes was 0.596 gm. for the first group and 0.74 for the second group. The atrophy of the testes could not be attributed to general inanition, since some body growth took place during exclusive feeding on rice, though symptoms of polyneuritis were manifested.

Genetic studies in poultry, II, III, R. C. PUNNETT and P. G. BAILEY (*Jour. Genetics*, 10 (1920), No. 4, pp. 277-292, pl. 1, figs. 13; 11 (1921), No. 1, pp. 37-57, pls. 5, figs. 2).—These two papers continue one previously noted (E. S. R., 41, p. 472).

II. Inheritance of egg color and broodiness.—The authors report results of reciprocal crosses between Black Langshans and Brown Leghorns and also the cross Langshan ♂ × Golden Penciled Hamburg ♀.

The F₁ pullets laid tinted eggs, but the color was much lighter than in the Langshan. The 65 pullets of the F₂ of the Langshan ♂ × Leghorn ♀ cross showed a wide variation in egg color, but most of the eggs were white or of a light tint and no eggs were as dark as the Langshan. It is suggested that the original pullets bore an inhibitor for egg color. In the reciprocal cross, in which the Leghorn cock was of a different strain, there was a wide range in egg color but no excess in the whites. In the F₂ Hamburg × Langshan cross, the distribution of egg color was bimodal with the dark tints predominating. Aside from the inhibitor, one factor of major importance producing color and several minor color factors are postulated to explain these results. There was no evidence of xenia in egg color as claimed by Holdefleiss (E. S. R., 26, p. 669).

Broodiness, which was determined by the behavior of the birds in the pullet year, was found to be a complex character. The F₁s were generally broody, but the proportion of broody to nonbroody in the F₂ varied greatly in the different crosses. There was no evidence of sex-linked transmission of broodiness, but it is thought that broodiness may be linked loosely to egg color.

The black down of the Langshan proved to be dominant over the brown striped down of the Leghorn and appeared to segregate in a simple 3:1 ratio. The F₁ males of the Langshan ♂ × Leghorn ♀ were black with dark eyes and shanks, while the F₁ females were black with varying amounts of orange and had orange eyes and light colored shanks. In the reciprocal cross the F₁ pullets had orange eyes and light shanks like the males. These differences are held to be due to a sex-linked factor.

III. Hen-feathered cocks.—In the experiments reported Golden Penciled Hamburg cocks were mated to Silver Sebright bantam hens. The results are explained on Morgan's hypothesis (E. S. R., 44, p. 470) that there is a dominant nonsex-linked gene for hen feathering. It is also suggested that a duplicate gene, sex-linked, occurs in all birds, thus accounting for the hen-feathering of the normal hen. Some "intermediate" birds appeared in the experiments, but so far as the observations went these became typically hen-feathered at later molts and are combined with the normal hen-feathered cocks in computing the ratios.

Semicastration of hen-feathered cocks resulted in some cases in the appearance of a few, generally transitory, male feathers on the side of the body on which the operation was performed. As in Morgan's experiments (E. S. R., 42, p. 466), complete castration was followed at the next molt by typical cock-feathering.

The mating and breeding of poultry, H. M. LAMON and R. R. SLOCUM (*New York: Orange Judd Co.; London: Kegan Paul, Trench, Trübner & Co., Ltd., 1920, pp. XXIV+341, figs. 97*).—This is a treatise on poultry breeding for persons beginning to raise standard-bred poultry. Chapters are devoted to the

principles of breeding, breeding for increased production, fitting poultry for the show, and each of the recognized classes of poultry including ornamentals and games.

Egg-laying tests at Hawkesbury Agricultural College, nineteenth year's results, 1920-21, F. H. HARVEY and J. HADLINGTON (*N. S. Wales Dept. Agr., Farmers' Bul. 138 (1921), pp. 23, figs. 6*).—This is a discussion of the New South Wales contest concluded March 31, 1921. Monthly individual egg records are tabulated for 540 pullets. As in the previous contest (*E. S. R., 43, p. 674*) a number of standard-bred pullets were included.

High-quality market eggs: Producing, handling, packing, G. H. POUND (*New Jersey Stas., Hints to Poultrymen, 10 (1921), No. 2, pp. 4, fig. 1*).—Suggestions are given for producing clean eggs, for improving the condition of dirty eggs, and for grading and packing eggs for market.

How to candle eggs, W. F. SCHOPPE (*Montana Sta. Circ. 97 (1921), pp. 19, figs. 2*).—Directions are given for candling eggs, together with a comparison of the appearance of the egg before candling and out of the shell, taken from Bulletin 565 of the U. S. Department of Agriculture (*E. S. R., 39, p. 279*).

Back yard poultry keeping, J. C. GRAHAM (*Mass. Dept. Agr., Dept. Bul. 11 (1921), pp. 40, pls. 2, figs. 6*).—This is the second edition of a publication previously noted (*E. S. R., 42, p. 69*).

DAIRY FARMING—DAIRYING.

Feeding dairy cattle, M. H. KEENEY (*New Jersey Stas. Circ. 127 (1921), pp. 38, figs. 7*).—Suggestions are given for feeding dairy cows for milk production in ordinary farm practice and for feeding under special conditions such as official tests and at calving time, together with notes on the feeding of dairy heifers until the age of first calving.

Feeding test cows at Cornell University, E. S. SAVAGE (*Holstein-Friesian World, 18 (1921), No. 42, pp. 19, 20, 50, 51, figs. 3*).—This is an account of the methods used at Cornell University for preparing Holstein cows for advanced registry tests and the methods of feeding during the test.

Notes on breeding for increase of milk in dairy cattle, E. ROBERTSON (*Jour. Genetics, 11 (1921), No. 1, pp. 79-90*).—From a study of six pedigrees of Kerry cattle, the author concludes that "inbreeding to a male relationship" tends to increase and "inbreeding to a female relationship" tends to decrease both the quantity and the quality of the milk produced. It is admitted that the data cited are not sufficient to prove this contention.

Selecting Jersey sires for high yearly production, R. E. HUNT (*Va. Agr. Col. Ext. Bul. 65 (1921), pp. 18*).—The author has gone over the volumes of the Register of Merit and listed the Jersey sires having a large number of daughters with high butter-fat records. In the discussion of the value of these lists the importance of a uniformly high production in the daughters is emphasized.

Yesterday and to-day in New Hampshire dairying, J. M. FULLER (*N. H. Agr., 36 (1919-1920), pp. 105-113, figs. 6*).—In this address the author discusses the increase in the number of dairy cows in New Hampshire since 1850 and the changes in the production and prices of dairy products.

The composition of milk in British East Africa, V. H. KIRKHAM and A. C. BARNES (*Analyst, 45 (1920), No. 533, pp. 298-301, figs. 3*).—The author presents graphs showing monthly averages during 1916 of the percentages of solids-not-fat and the Reichert-Meissl number of the fat in the milk produced by a herd of about 60 native cows, mostly zebu, in British East Africa.

The percentage of fat was highest from May to July and lowest in October and November, with a secondary minimum in February. The temperature

curve showed parallel fluctuations, but these occurred in each case about three months before the rise or fall in fat content. The correspondence is attributed to the fact that the bulk of the cows calved in September or October, three months after the minimum winter temperature, and not to a delayed influence of temperature on milk secretion, either direct or through changes in the pasture. The fact that the changes in fat percentage and temperature in England are parallel and show no lag, as observed by H. D. Richmond, is attributed to the accident that freshening usually occurs at the appropriate point in the temperature cycle.

Variations in bacteria counts from milk as affected by media and incubation temperature, G. C. SUPPLEE, W. A. WHITING, and P. A. DOWNS (*New York Cornell Sta. Mem. 43 (1921), pp. 221-247*).—The authors compared three media and three incubation temperatures by making parallel counts on 100 samples of market milk derived from the ordinary Ithaca supply. The following table summarizes the counts in comparison with those obtained by the standard procedure, viz, incubation at 37° C. for 48 hours with a plain agar medium:

Influence of medium and incubation method on bacterial counts of market milk.

Incubation temperature.	Incubation time.	Relative counts.		
		Plain agar.	Lactose agar.	Dextrose agar.
°C.	Hours.			
37	48	100.0	175.3	444.9
30	120	519.1	453.5	773.6
20	120	411.4	498.5	664.8

The carbohydrate media were made up with 1 per cent lactose or dextrose.

In a supplemental study of the influence of the method of stacking the Petri dishes in the incubator on the counts by the standard procedure, the authors found that the lowest counts and the greatest variability (as measured by the standard deviation and the coefficient of variability) occurred in the interior of a solid block of dishes. Relatively high and uniform counts were secured where the dishes were exposed to the warm circulating air of the incubator.

The production of ammonia and carbon dioxid by streptococci, S. H. AYERS, P. RUPP, and C. S. MUDGE (*Jour. Infect. Diseases, 29 (1921), No. 3, pp. 235-260*).—This study from the Dairy Division of the U. S. Department of Agriculture deals with the production of ammonia and carbon dioxid in 485 cultures of streptococci.

Two general classes of media were used, one containing peptone and the other peptone and dextrose. All the 64 cultures of hemolytic streptococci isolated from pathological sources and from normal human throats had the combination of cultural characteristics which the authors designate A, i. e., both NH₃ and CO₂ are produced from peptone alone. Combination A also characterized 95 of the 115 cultures isolated from cows' udders, 34 of the 124 cultures isolated from sour milk derived from individual farms, and 90 of the 96 cultures made from mixed sour milk from the same farms. The differences between the two classes of sour-milk organisms is attributed in part to the fact that the mixed milk was allowed to reach a slightly higher acidity.

With the exception of two organisms isolated from cow feces, which differed from the hemolytic streptococci only in being unable to form NH₃ in the peptone-dextrose medium (combination E), none of the other organisms produced ammonia. Streptococci incapable of producing CO₂ from either source

(combination B) formed 75 of the 78 cultures from cow feces, 13 of the individual sour-milk cultures, and 4 of the 8 cultures made from active commercial lactic starters. The cultures from the other starters showed combination A. The production of CO₂ from dextrose but not peptone (combination C) was typical of the sour-milk cultures derived from individual farms (77 cultures) and was found in 6 of the mixed-milk cultures, but was not observed in cultures secured from any of the other sources. Twenty of the udder organisms had a culture combination designated D, which differed from B in that a certain quantity of carbon dioxide was formed in the peptone cultures, although the source seemed to be the organic acids present and not the peptone. None of the organisms from other sources showed combination D.

The failure of a number of previous investigators to detect the production of CO₂ by streptococci is attributed to the kind of fermentation tubes used. The authors find that the Eldredge fermentation tubes measure small amounts of CO₂ quite accurately. They also find that not all commercial peptone preparations are suitable sources of carbon dioxide.

The amounts of CO₂ and NH₃ liberated by the cultures were small but quite uniform, and it is believed that the differences observed represent fundamental differences in the physiology of the organisms which will be of distinct use for diagnostic purposes.

On the claim that some typhoid-paratyphoid strains survive the milk pasteurization, C. KRUMWIEDE and W. C. NOBLE (*Jour. Infect. Diseases*, 29 (1921), No. 3, pp. 310-312).—The authors experimented with various bacilli of the typhoid-paratyphoid group, including some strains used in the experiments of Twiss (*E. S. R.*, 45, p. 380), and find no evidence that any types survive heating to 60° C. for 20 minutes. The failure of Twiss to secure similar results is attributed to the use of cotton plugged flasks which were not submerged completely in the bath.

Contributions to the knowledge of the chemistry of cream, A. BURR and C. LINDEMANN (*Molk. Ztg. [Hildesheim]*, 35 (1921), Nos. 49, pp. 1229, 1230; 50, pp. 1257, 1258; 51, pp. 1273, 1274; 52, pp. 1305, 1306).—The authors report chemical analyses of a large number of samples of cream and review the literature concerning the composition of Devonshire clotted cream, powdered cream, cream cheese, etc., the object being partly to determine the influence of added water on the chemical composition of cream and partly to compare the cream products with whole milk.

Butter and cheese, C. W. WALKER-TISDALE and J. JONES (*London and New York: Sir Isaac Pitman & Sons, Ltd.*, 1920, pp. IX+142, pl. 1, figs. 38).—This is a manual for the use of beginning butter makers and cheese makers in Great Britain.

[Butter and cheese investigations at the West of Scotland Agricultural College] (*Scot. Bd. Agr. Rpt.*, 9 (1920), p. XLII).—This is a brief note of progress in experimental work.

In the butter experiments it was found that the texture of the flavor was improved by washing and brining the granular butter with pasteurized lactic whey and by adding milk sugar to the butter when on the workers. Various cheeses of the Cheddar type were made by the use of selected lactic ferments, including *Streptothrix dadhi*, *Bastonicini lactici coagulantes*, *Bacillus bulgaricus*, and Freudenreich's bacillus. When ripe these cheeses usually had a fine distinctive flavor superior to that of the control cheeses made with *Streptococcus lacticus* starter. The coefficient of digestibility was high in the case of the experimental cheeses, and they were easily assimilated by persons of comparatively weak digestion.

Contributions to the knowledge of the composition of different kinds of cheese, A. BURR, M. STEFFEN, and C. LINDEMANN (*Molk Ztg. [Hildesheim]*, 35 (1921), Nos. 28, pp. 727, 728; 29, pp. 743, 744; 30, pp. 775, 776).—The authors report chemical analyses of 39 samples of Tilsit cheese and of a lesser number of samples of other types, including Cheddar, Schweizer, Gouda, Edam, Wilster, Holstein skim milk, Harz, Danish and German Brick, Camembert, Neufchâtel, Brie, Frühstück, cottage cheese, cooked cheese, curd, Sapsago (Krauter Käse), handmade cheese, sheep's milk cheese from the Holstein marsh region, and sheep's milk cheese from the North Sea region. Notes on methods of manufacturing are given in some cases.

Cheese-making experiments with milk from cows fed fruit and fruit skins, A. PETER (*Jahresber. Molk. Schule Rütli-Zollikofen*, 33 (1919-20), pp. 24-32).—Of 29 experimental cheeses made from milk of cows fed fruit and fruit skins all developed off flavors and were of inferior quality.

Economics of the ghee trade, D. ANANDA RAO (*Madras Agr. Dept. Year-book*, 1919, pp. 75-83, pls. 3).—The author describes the ordinary method of making ghee in India and reports experiments in which ghee was made in the laboratory. From a study of the yield of curd, butter, and finished product, it is concluded that in ordinary practice a considerable amount of butter fat is lost in churning. Much of the ghee sold on the market is adulterated, and this is attributed in part to the fact that pure ghee can not be manufactured profitably at the usual price.

Review of the imported dairy produce trade for the year ended June 30, 1921, W. WEDDEL & Co., LTD. (*Weddel's Ann. Rev. Imported Dairy Prod. Trade*, 27 (1921), pp. 8).—A statistical summary of imports of butter and cheese into the United Kingdom, with notes on dried milk and margarin.

VETERINARY MEDICINE.

A textbook of the diseases of the small domestic animals, O. V. BRUMLEY (*Philadelphia: Lea & Febiger*, 1921, pp. XXIV+17-672).—This is a practical textbook on the diseases of the dog, cat, rabbit, poultry, etc., an attempt having been made to include most of the diseases with which the veterinarian comes in contact.

The farmer's practical veterinary guide, E. T. STEELE ([*Chillicothe, Mo.*]: Author, 1921, pp. 222, pls. 4, figs. 20).—This is a popular account which is said to be based upon years of experience.

Report of the Civil Veterinary Department, Assam, for the year 1920-21, W. HARRIS (*Assam Civ. Vet. Dept. Rpt.*, 1920-21, pp. 2+17).—This is the usual annual report (E. S. R., 44, p. 275).

Practical treatise on serology and serum diagnosis, M. RUBINSTEIN (*Traité Pratique de Sérologie et de Sérodiagnostic. Paris: A. Maloine & Sons*, 1921, pp. 414, pls. 2, figs. 22).—While this volume is essentially a treatise on the serum diagnosis of syphilis, it contains much information of a general nature on the principles of immunity and serological reactions, together with special sections on the serum diagnosis of tuberculosis, echinococcosis, and cancer, brief comments on the serum diagnosis of the other diseases, and a final section on the possible applications of the Abderhalden reaction.

The rôle of lipoids in infection and immunity, G. LINOSSIER (*Les Lipoides dans l'Infection et dans l'Immunité. Paris: Libr. J.-B. Baillière & Sons*, 1920, pp. 105).—A theoretical discussion.

Studies on complement fixation.—I, The rate of fixation of complement at different temperatures, R. L. KAHN (*Jour. Expt. Med.*, 34 (1921), No. 3, pp. 217-230, figs. 7).—Essentially noted from another source (E. S. R., 45, p. 681).

The treatment of Malta fever and bovine contagious abortion with collargol and similar preparations. H. ZIEMANN (*Deut. Med. Wchnschr.*, 47 (1921), No. 18, p. 500; *abs. in Vet. Rec., n. ser.*, 1 (1921), No. 38, pp. 751, 752).—The author reviews a report of Zeller¹ on the relationships that exist between contagious abortion of cattle and Malta fever, which led to the conclusion that the usual laboratory methods of examination fail to establish any important differences between the causal agents of the two diseases. Their epidemiological characteristics also present striking similarities.

The author reports that he has succeeded in curing four cases of Malta fever through the intravenous injection of from 2 to 4 cc. of a 2 per cent solution of collargol. These cases have been confirmed by bacteriological examination and had previously withstood all other forms of treatment. In the first case a single injection was sufficient, but in the other cases treatment was rendered effective by the administration of a second injection on the second day. The injections were given at the height of the febrile attack. The onset of convalescence was marked a few hours after the injection by profuse sweating and a sharp fall in temperature. Subsequent recovery was uneventful. The extraordinary rapidity with which results were obtained in the treatment of Malta fever cases at once suggests that the preparation exerts a direct bactericidal action and not merely an indirect effect by stimulating protoplasmic activity.

The importance of an increased carbon dioxid tension in growing *Bacterium abortus* (Bang). I. F. HUDDLESON (*Cornell Vet.*, 11 (1921), No. 3, pp. 210-215, fig. 1).—The studies here reported are considered to furnish sufficient proof that the growth of *B. abortus* is not due to a reduced oxygen tension, that a carbon dioxid tension greater than that of the air governs and greatly facilitates its primary growth, and that an atmosphere containing 10 per cent of carbon dioxid gas appears to produce the earliest and most luxuriant growth of *B. abortus*.

The complement deviation reaction, the reaction of Sachs-Georgi, and the reaction of Meinicke in the diagnosis of dourine. L. COMINOTTI (*Clin. Vet., Rass. Polizia Sanit. e Ig. [Milan]*, 44 (1921), No. 4, pp. 81-91; *abs. in Abs. Bact.*, 5 (1921), No. 6, pp. 241, 242).—Tests of the value of the complement deviation reaction for the diagnosis of dourine are reported, from which the author concludes that the test is significant only when the result is positive. In many cases negative results were obtained with sera of animals showing typical clinical symptoms. Occasionally a negative reaction is given in primary stages of the disease and a positive one in later stages. The Sachs-Georgi and Meinicke reactions are considered to be without value in the diagnosis of dourine.

Experimental investigation of foot-and-mouth disease. O. WALDMANN and J. PAPE (*Berlin. Tierärztl. Wchnschr.*, 37 (1921), No. 30, pp. 349-354, pl. 1).—In continuation of previous studies (*E. S. R.*, 45, p. 76), the authors have extended their experimental study of foot-and-mouth disease in guinea pigs and have succeeded in producing the disease in over 200 animals. The course of the infection was found to depend to a great extent on the method of inoculation. Cutaneous inoculation in a manner similar to small-pox vaccination results in local manifestation in about 24 hours, followed in from 2 to 5 days by general symptoms and typical foot-and-mouth lesions. Following intravenous inoculation there is a slight rise in temperature after about 24 hours, but the first specific symptoms do not appear for about 3 days. Attempts to produce the disease spontaneously by exposure to infected animals resulted negatively.

¹ Berlin. Tierärztl. Wchnschr., 36 (1920), No. 30, pp. 345-347.

Over 90 transfers of the virus have thus far been made with no decrease but rather an increase in virulence.

The authors have further demonstrated that, simultaneously with or shortly after the appearance of general symptoms of foot-and-mouth disease in guinea pigs induced by intracutaneous inoculation of virus, a tissue immunity is established as shown by negative reaction following subcutaneous inoculation of the virus. Two commercial preparations for the treatment of foot-and-mouth disease, Athanal and Sano, were found to be ineffective.

The value of the lid test for glanders, O. WILKE (*Monatsh. Prakt. Tierheilk.*, 32 (1921), No. 5-6, pp. 245-250).—In this brief report of an investigation of the value of the lid or intrapalpebral test for glanders, particularly in conjunction with serological tests, the author concludes that the test is of great value, especially in doubtful cases in which the serological tests are positive and the ordinary eye tests negative. In these cases decision should be based upon the results of the intrapalpebral tests. Interference with the serological tests, noted by Fröhner and Habersang (*E. S. R.*, 45, p. 481), occurred in only 2.75 per cent of 109 glanders-free horses examined by both tests.

A convenient modification in the administration of the blood of the dam in the treatment of joint-ill, SACHWEH (*Berlin. Tierärztl. Wehnschr.*, 36 (1920), No. 23, p. 259).—As a simple method of defibrinating blood to be used in the treatment of joint-ill in foals, the author recommends shaking the blood with sterilized glass beads as it is received in clean glass flasks. To avoid the danger of embolism following the injection of the defibrinated blood intraperitoneal instead of intravenous injection is recommended.

A comparative study of "grippe" of man and the affection of the horse known as contagious pleuro-pneumonia (equine grippe), E. BEMELMANS (*Rev. Gén. Méd. Vét.*, 30 (1921), Nos. 355, pp. 377-391; 356, pp. 441-462).—In the course of this account the author deals at length with the symptomatology, bacteriology, and epidemiology of these affections. The study has led him to conclude that the influenza of man and contagious influenza of the horse are similar in their epidemiology.

A method of antirabic vaccination with phenolated emulsions of fixed virus of graduated virulence, V. PUNTONI (*Ann. Ig. [Rome]*, 31 (1921), No. 7, pp. 389-407, figs. 2).—The method described, which has not only been tested on experimental animals but has been in successful practical use for a year at the Antirabic Institute at Rome, depends upon the ability of phenol to destroy the virulence of rabic virus to an extent proportional to various factors, particularly concentration and time (*E. S. R.*, 45, p. 684). It is thus possible to prepare phenolated emulsions of rabic virus of increasing virulence which can then be used in a manner similar to the Pasteur vaccine, starting with a practically avirulent material and continuing with material of gradually increased virulence.

The vaccine is prepared according to the Fermi method (*E. S. R.*, 37, p. 480) by emulsifying 5 gm. of nerve tissue from a rabbit dead from fixed virus with 100 cc. of a 1 per cent solution of phenol. With the temperature kept constant at 21° C., the virulence will depend upon the length of time the tissue remains in contact with the phenol solution. The usual technique of vaccination consists in 44 injections in 22 days of 7-gm. doses of the material. In grave cases from 60 to 100 injections of from 9 to 15 gm. each are given in a period of 26 days. The serum of those vaccinated by this method is said to have higher rabicidal power than that of those vaccinated by the Pasteur method. The method has also practical advantages over other methods of vaccination, particularly the Pasteur method.

Rinderpest, S. PAVÉ (*An. Soc. Rural Argentina*, 55 (1921), No. 13, pp. 511-518).—This is a summary of information on rinderpest followed by an account of its appearance in Brazil.

The preparation of rinderpest serum in Poland, R. MANNINGER (*Allatorosi Lapok*, 44 (1921), No. 3-4, pp. 13, 14; *abs. in Jour. Amer. Vet. Med. Assoc.*, 59 (1921), No. 5, pp. 632-634).—This paper describes the efforts that are being made to eradicate rinderpest from Poland. All infected animals are slaughtered and the remaining cattle are vaccinated as fast as possible with serum prepared by the Jaroszinski method as follows:

Cattle from uninfected territories are inoculated intravenously with 5 cc. or subcutaneously with 10 cc. of virus. After 6 or 7 days, when the animals have become feverish and lesions have appeared in the mucous membrane of the mouth, the animals are bled from the carotid artery into glass tubes with rubber hose leading to large sterile glass jars. The blood, after being defibrinated, is filtered through sterile gauze into sterilized graduates from which it is injected subcutaneously into the animal to be hyperimmunized. Animals used for this purpose are mature cattle which have recovered from a natural infection. Four subcutaneous inoculations of 2 liters of virus each at 10-day intervals are considered sufficient for hyperimmunization. The blood is drawn from the hyperimmunized animals 14 days after the fourth injection and again 10 days later. This procedure may be carried out indefinitely, the only precaution being to inoculate the animal with 2 liters of virus after every second bleeding.

The average production of virus from an animal weighing from 200 to 500 kg. is from 8 to 10 liters, while of the hyperimmune blood the amount which can be withdrawn varies with the weight of the animal, as a rule 250 cc. being drawn for every 16 kg. of live weight at every bleeding. The serum after the addition of 0.5 per cent phenol solution is tested for potency as follows:

Nine control animals are each given 5 cc. of virulent blood subcutaneously, three animals receive 3 cc., three 2.5 cc., and three 2 cc. of serum for every 16 kg. of live weight. The best dosage for practical purposes is thought to be one that will produce an elevation of temperature to a point not to exceed 40° C. in from 24 to 48 hours after the injection.

Contribution to the curative value of tetanus antitoxin in equine tetanus, E. MÖRIG (*Monatsh. Prakt. Tierheilk.*, 32 (1921), No. 5-6, pp. 250-265).—The author reports successful results in the use of massive doses of tetanus antitoxin in the treatment of tetany in horses. It is recommended that the antitoxin be administered in amounts equivalent to 2 or 2½ units per kilogram of body weight. The German unit (A. E. or antitoxineinheiten) is the amount required to neutralize 1 gm. of normal tetanus toxin, the amount of toxin necessary to kill a 15-gm. mouse. The antitoxin is administered intravenously, and the treatment is repeated with larger doses until visible improvement is noted. The large doses of antitoxin are thought to neutralize not only the freely circulating toxin but the previously bound toxin set free by the neutralization of that already in circulation.

Trypanosoma lewisi in Boston rats, S. WARREN (*Jour. Med. Research*, 42 (1921), No. 4, pp. 419-437, figs. 2).—"Of 2,009 rats from the city of Boston examined in the first four months of 1921, 341, or 17 per cent, were infected with *T. lewisi*. Examination was made by means of stained smears. No other blood parasites than *T. lewisi* were found. The infection is probably least at the season of the year during which the work was done. The infection in Boston is apparently localized in the market district, with outlying

foci along the water-front; but this is probably due merely to the migration of infected rats in toward the market. Only a very small percentage of infected rats showed division forms in their blood, due probably to unfavorable climatic conditions for transmission. No infected rats showed definite lesions, but nearly all showed blood changes."

A map showing the geographic distribution of *T. lewisi* is given and a summary of the data on which it is based. Seventy-five references to the literature are included.

The focal reaction. W. F. PETERSEN (*Amer. Rev. Tuberculosis*, 5 (1921), No. 3, pp. 218-235).—This is a theoretical discussion of the focal reaction, with special reference to tuberculosis. In the mechanism of this reaction in tuberculosis it is considered that at least three factors are involved: "(1) A true and strictly specific sensitization of the organism, (2) a general hypersensitiveness of the organism against proteins, and (3) a nonspecific reaction about the tubercle. This latter is of course greatly modified by the anatomical peculiarities of the tubercle (avascularity, encapsulation, accumulation of necrotic material, resistance of the tubercle bacillus, etc.)."

The intracutaneous tuberculin test and the eyelid test in fowls. K. RÖMER (*Monatsh. Prakt. Tierheilk.*, 32 (1921), No. 5-6, pp. 266-275, fig. 1).—The intracutaneous tuberculin test applied to the wattle or ear lobes is considered by the author to be the only satisfactory method for the tuberculin testing of fowls. Attention is called to the fact that the specific reaction can not be detected before 24 hours at the earliest and sometimes does not appear before three days. An interval of at least two weeks should elapse before repeating the test. The second test generally gives a stronger reaction than the first, but a third test is considered of no diagnostic value. Tuberculin testing of the eyelids was found to be of no value.

A tuberculosis immunizing vaccine. N. RAW (*Brit. Med. Jour.*, No. 3147 (1921), pp. 594-596).—The author claims to have rendered pure cultures of human, bovine, and avian tubercle bacilli entirely avirulent by subculturing on glycerin potato and transferring to glycerin agar monthly for a long period of time. No change in virulence was noted until the ninety-fourth generation, after which attenuation was very rapid until the cultures became entirely avirulent. With these nonpathogenic cultures bacillary emulsion vaccines have been prepared which have been used in immunizing susceptible children and in the treatment of active tuberculosis.

The author is of the opinion that in the human body there is a marked antagonism between human and bovine tuberculous infections, and that disease of one type produces immunity to the other. For this reason the use of vaccines prepared from bovine cultures is recommended for the treatment of human infections and vice versa.

The Mexican whorled milkweed (*Asclepias mexicana*) as a poisonous plant. C. D. MARSH and A. B. CLAWSON (*U. S. Dept. Agr. Bul.* 969 (1921), pp. 16, pls. 2, fig. 1).—This is a report of investigations carried on in continuation of those with the whorled milkweed (*A. galioides*), previously noted E. S. R., 43, p. 470), and with *A. pumila* and *A. verticillata geyeri* (E. S. R., 45, p. 178).

The Mexican whorled milkweed is a western species which ranges from Mexico northward through California, western Nevada, and southern Washington to eastern Idaho, being especially abundant in California. It has long been considered a stock-poisoning plant, particularly dangerous to sheep, although there has not previously been any definite knowledge of the symptoms produced by it or of its toxic dosage. The experimental work here reported shows that it produces effects very similar to those produced by the three whorled milkweeds

mentioned above. Its toxicity is about equal to *A. pumila* and about one-fourth that of *A. galioides*. Its lethal dose is six times that of *A. galioides*, but about one-half that of *A. pumila*. The present investigations indicate that many of the cases of poisoning attributed to *A. speciosa*, *A. eriocarpa*, and *A. fremonti* are really due to *A. mexicana*.

A technical description of *A. mexicana* by W. W. Eggleston is included. Studies of this plant in Nevada, by Fleming and his associates, have been noted (E. S. R., 44, p. 874).

Historical notes on cotton seed as food, I. G. MACY (*Jour. Dairy Sci.*, 4 (1921), No. 3, pp. 250-265).—Included in this paper is a review of previous work relating to the causes of cottonseed meal injury, with references thereto.

Report of the committee on bovine diseases; their relation to the milk supply and to public health, H. YOUNG (*Internatl. Assoc. Dairy and Milk Insp. Ann. Rpt.*, 9 (1920), pp. 39-44).—This is a report presented at the ninth annual meeting of the International Association of Dairy and Milk Inspectors at Chicago in 1920.

State laws and court decisions relating to cattle-tick eradication, compiled by H. GODING (*U. S. Dept. Agr., Dept. Circ.* 184 (1921), pp. 71).—This is a compilation from official publications of State laws and court reports.

Preliminary notes on parasites found in ruminants at the municipal abattoir, Baton Rouge, La., G. DIKMANS (*Louisiana Stas. Bul.* 183 (1921), pp. 3-13, figs. 12).—This is a report of anatomical studies of *Haemonchus similis*, a stomach worm described from cattle in Brazil by L. Travassos in 1914 and in 1921 from Europe, which has been collected by the author from the abomasum of cattle at the municipal abattoir at Baton Rouge, La. This is said to be the first record of its occurrence in North America. Notes are also presented on the anatomy of *H. contortus*, on the variation in size of some specimens of *Bunostomum phlebotomum* from the fourth stomach of calves, and the occurrence of *Arduenna strongylina* and *Physocephalus sexalatus* in swine at Baton Rouge.

The cause of black disease and its method of transmission, being further studies in a braxy-like disease of sheep, S. DODD (*Agr. Gaz. N. S. Wales*, 32 (1921), Nos. 6, pp. 397-402; 7, pp. 503-511; 8, pp. 569-574; 9, pp. 621-625, pls. 4).—This has been noted from another source (E. S. R., 45, p. 685).

Report of the departmental committee appointed to inquire as to the practicability of disinfection of horsehair, W. MIDDLEBROOK ET AL. (*London: Govt.*, 1921, pp. 17).—This is a report of a committee of 12 upon experiments which thoroughly demonstrated that the process devised for the disinfection of wool (E. S. R., 40, p. 783) is efficient for disinfection of horsehair, and can be satisfactorily applied to both mane and tail hair without causing manufacturing difficulties.

Data on the development of *Heterakis papillosa* in the fowl, H. W. GRAYBILL (*Jour. Expt. Med.*, 34 (1921), No. 3, pp. 259-270, pl. 1).—The demonstration that the round worm (*H. papillosa*) inhabiting the ceca of chickens, turkeys, and certain other birds (peafowl, guinea fowl, various pheasants, partridge, grouse, quail, bustard, and the domestic duck and goose) is a factor in the production of the disease popularly known as blackhead (E. S. R., 43, p. 475), has led the author to conduct the biological studies here reported upon, his summary of which is as follows:

"In observations on the development of the ova of *H. papillosa* in cultures, it was found that they failed to develop at a temperature ranging from 2.5 to 8° C., but developed slowly at a temperature of 11.5 to 13.5°. The minimum temperature for development seems to lie between 8° and 11.5 to 13.5°. At

temperatures ranging in various cultures from 18 to 29° ova developed to their final stage in 7 to 12 days.

"Undeveloped ova subjected to a freezing temperature for a period of 4 days were viable at the end of that time. Fully developed ones remained alive when exposed out of doors for a period of 7 days at a temperature ranging from 5 to 62° F. Undeveloped ova survived desiccation at room temperature for a period of 16 days, but not for 41 days. Fully developed eggs were alive after desiccation for 18 days, but not after 49 days. In another instance they were no longer viable after 10 days. Embryos within ova kept in physiological salt solution at room temperature survived during a period of a little over 12 months. Fully developed ova kept in soil outdoors under circumstances approaching natural conditions contained living embryos after a period of 8 months.

"From a study of a series of artificially infested chickens killed at short intervals it appears that the ova of *Heterakis hatch* in the small intestine and the larvae pass by way of the small and large intestines to the ceca, where they undergo development to maturity. Larvae found in the mucosa of the ceca were not in an encysted condition. Feeding of numerous artificially incubated ova may lead to a light infestation, the cause of which has not been definitely determined. A period of 57 days was required for larvae to reach maturity in a host. The entire cycle from egg to adult requires a minimum time of about 64 days. A brief study of the growth and development of larvae within the host has been made. No evidence was found of a migration through the tissues. A few penetrate into the mucosa of the ceca."

The use of carbon tetrachlorid for the removal of hookworms, M. C. HALL (*Jour. Amer. Med. Assoc.*, 77 (1921), No. 21, pp. 1641-1643).—Attention is called to experiments conducted with dogs, previously noted (E. S. R., 45, p. 286), which indicate that carbon tetrachlorid is very effective against blood-sucking strongyles and moderately effective against ascarids. In order to test its effect, the dose found effective in freeing dogs of hookworms, namely, 3 cc. in hard capsules, was swallowed by the author without producing symptoms of discomfort. Toxicity tests with monkeys gave similar results. It is pointed out that, while this drug is apparently of no value for removing tapeworms and is as unreliable as other anthelmintics for removing hookworms, it is apparently more effective, safer, and cheaper than the drugs used at present to remove hookworms.

RURAL ENGINEERING.

Agriculture and irrigation in continental and tropical climates, K. D. DOYLE (*London: Constable & Co., Ltd.*, 1921, pp. XV+268).—This book is intended to supply information which might be useful to those who intend to undertake agricultural pursuits in tropical climates, more especially in the British possessions where irrigation is required and alkaline soils are encountered. Chapters are included on soil; fertilizers; irrigation; wells and pumping; dry farming and economics; pastures—natural and artificial; notes on forests, cattle, pigs, and carobs; runs and farms for sheep and ostriches; cereals; apples; asparagus, onions, and potatoes; citrus orchards; grapes, walnuts, and pistachio nuts; some special industries; tropical fruits; tropical plantations; planting and sowing for oil; and tropical agriculture.

Ground water for irrigation near Gage, Ellis Co., Okla., D. G. THOMPSON (*U. S. Geol. Survey, Water-Supply Paper 500-B* (1921), pp. 33-53, pl. 1, figs. 3).—The results of a field examination to determine the possibility of obtaining water for use in irrigation from deep wells within a radius of 30 miles from

Gage, Ellis Co., Okla., are presented in this report. This area lies almost entirely within the High Plains region.

The conclusion is reached that there is no reasonable prospect of obtaining water suitable for irrigation in this region except in small areas. The water obtained from shallow wells on the uplands is much less saline and is generally suitable for irrigation, but in many places the depth from which it would have to be pumped would be too great for profitable irrigation.

Effect of curvature upon flow in open channels, H. P. EDDY (*Engin. News-Rec.*, 87 (1921), No. 13, pp. 516, 517).—An analysis of considerable data on the subject is given, indicating that the information is so fragmentary and indefinite that it is impossible to draw entirely satisfactory conclusions, but that it is apparent that in artificial channels for which the coefficient n in Kutter's formula will not exceed about 0.025 for a straight channel, an addition of from 0.003 to 0.005 should be made to the coefficient for sections in which the amount of curvature is considerable. It is considered probable that the frictional loss due to curvature varies with the radius of curvature and with the velocity of flow, which should be made the basis for further study.

Mechanical tests of some commercial Philippine timbers, F. V. VALENCIA (*Philippine Jour. Sci.*, 18 (1921), No. 5, pp. 485-535, pl. 1, figs. 19).—This is a preliminary report on mechanical tests of Philippine woods being conducted by the Bureau of Science in cooperation with the Bureau of Forestry of Manila, the purpose being to provide a basis for the comparison of species, as well as for the establishment of working stresses for use in connection with the design of timber structures.

The study was divided into tests of structural timbers and standard tests of small specimens free from defects. Five different wood species were tested, including tangile, apitong, guijo, lumbayan, and gisok. The mechanical properties of the woods tested were found to vary greatly, not only in the specimens from different trees of the same species but also in those cut from different portions in the same tree. This is thought to be due largely to the defects they contained and to their lack of homogeneity as compared with steel and other metals. Small specimens were less variable in strength than the structural sizes. In general the dry weight had a distinct tendency to increase as the modulus of rupture increased. Where a heavy timber of structural size had a low modulus of rupture, it was generally found that the timber had serious defects on or near the tension face. The strength of specimens having the same dry weight sometimes varied considerably. Other things being equal, the strength of the woods varied directly with their dry weight.

A comparison of the results of tests on air-seasoned material with those of green material showed that in general all of the mechanical properties were improved by seasoning. Increase in strength was especially marked on small pieces free from defects. Variations in the rate of application of load had a very pronounced effect upon strength and stiffness.

It is stated, in conclusion, that the character and location of defects in timber have much to do with its strength. Checks in beams weaken their resistance to horizontal shear, particularly if the defects occur near the neutral plane. The experiment showed that knots occurring in the central lower part of a beam weaken the timber much more than similar defects found in another part.

An appendix giving formulas used in computations and a glossary of terms are included.

Effects on concrete of immersion in boiling water and oven drying, W. J. SCHLICK (*Iowa Engin. Expt. Sta. Bul.* 59 (1921), pp. 24, figs. 13).—Studies made to determine standard methods for testing drain tile are reported.

When determining the methods for testing the resistance of draintile to injury from repeated freezing and thawing whole tiles were subjected to a natural freezing and thawing test, and pieces from tile of the same lots were subjected to an artificial test in which the specimens were frozen in a refrigerating box and thawed in boiling water. The variations between the results for concrete tile in these two tests were so great as to warrant studies to determine their cause.

It was found that immersion in boiling water even for 15 and 30 minute periods caused a marked reduction in the strength of concrete tile. The initial immersion had a much larger effect than any subsequent immersion. Because of these facts it is concluded that a freezing and thawing test in which the specimens are immersed in boiling water, either in the preliminary absorption test or in the thawing treatment, becomes primarily a strength test by which the effect of the boiling may be measured.

Immersion in boiling water for five hours, followed by cooling in water, increased the amount of moisture in the pores of the concrete over that when the specimen was immersed in water at room temperature for 72 hours. This increase averaged about 40 per cent for pieces from concrete draintile, but varied with the character and quality of the concrete. Immersion in boiling water, followed by cooling in water, of concrete specimens cured in water without previous drying, caused a small but consistent loss in weight. Since this loss in weight was accompanied by a loss in strength, it is concluded that both actions are due to physical changes caused by chemical actions set up by the high temperature in the presence of moisture.

The tests also indicated that the effect of oven drying on strength is actual, but is so small as to be wholly obscured if the specimen is boiled also. It seemed, however, that the effect of drying was approximately constant at all temperatures from 50 to 180°C., and an increase in drying temperature seemed to counteract slightly the effect of subsequent boiling. The loss of weight due to drying and the percentage of absorption in either test increased, and consequently the time of drying decreased, as the drying temperature was increased.

It is concluded that immersion in boiling water causes a rapid continuation of the process of hydration or setting, and that this is accompanied by physical changes, possibly more or less temporary, that cause the change in weight and the loss in strength.

"While these studies have shown that immersion in boiling water reduces strength and increases the percentage of absorption, and that taking check weights after longer drying periods gives slightly higher absorption results, there seems to be no valid reason why the more rapid 'standard' boiling absorption test should not be retained for specimens that are not to be used in subsequent tests."

New laboratory abrasion test for concrete, C. H. SCHOLER (*Engin. News-Rec.*, 87 (1921), No. 12, pp. 488, 489, figs. 4).—A new abrasion test for concrete to simulate the abrasion on the surfaces of concrete roads is described which is being developed by the engineering experiment station of the Kansas State Agricultural College. The test consists of casting 9-in. spheres of the concrete to be tested and, after proper aging and curing, submitting them to abrasion in a standard brick rattler using a standard abrasive charge. It has been found that the full hour's run of 1,800 revolutions is not necessary, but that 900 revolutions gives sufficient loss on even the toughest specimens to indicate the relative resistance to abrasion offered by the material.

The results of a number of tests of different mixtures are reported, representing a large range of aggregates. These indicate that the method of

testing is entirely practicable and possessed of several advantages over other tests so far developed. A visual inspection of test samples indicates the desirability of a coarse aggregate of smaller size than is commonly required for one-course concrete work. It is believed that the improved wearing value shown by the richer mixtures used for the wearing course of a pavement is due largely to the finer coarse aggregate used in such mixtures. The mortar bond on gravel or stone breaking with a glassy fracture is not strong enough to permit the use of this test at ages earlier than 60 days, as the aggregate breaks out of its bedding.

A. S. T. M. standards, 1921 (*Philadelphia: Amer. Soc. Testing Materials, 1921, pp. 890, pls. 4, figs. 136*).—These standards include, among other things, specifications for draintile, road and paving materials, and structural and building materials in general, together with methods of testing.

Public Roads (*U. S. Dept. Agr., Public Roads, 4 (1921), No. 7, pp. 28, figs. 26*).—This number of this periodical contains the usual project statements under Federal-aid allowances approved in September, 1921, and the following articles:

Tests of Impact on Pavements by the Bureau of Public Roads, by C. A. Hogentogler (see below); "Rolled-Base" Brick Roads in Ohio, by A. T. Goldbeck and F. H. Jackson; Army Materials Ingeniously Used by States for Road Construction; Ball Test Applied to Concrete, by W. K. Hatt; Simple Slide Rule Solution of Vertical Curve Formula, by R. E. Royall; West Virginia Girl Wins Four Years' University Scholarship; and University of Michigan Offers Short Course in Highway Engineering and Transport.

Tests of impact on pavements by the Bureau of Public Roads, C. A. HOGENTOGLER (*U. S. Dept. Agr., Public Roads, 4 (1921), No. 7, pp. 1-18, 27, figs. 11*).—In the second article of this series (*E. S. R., 46, p. 186*), the behavior of the various pavement slabs in terms of the impact force which they sustained is reported. For purposes of comparison the various sections of pavement are grouped as concrete surfaces, monolithic brick surfaces, brick surfaces on concrete bases with 1-in. sand-cement cushions, and brick surfaces on concrete, macadam, and earth bases with sand and screening cushions.

The tests of the concrete sections showed that slabs of 2-in. thickness are impracticable for road surfaces and that slabs 4 in. in thickness can barely resist the static load of the heavier trucks without cracking, so that they surely would fail under impact of such trucks. It is indicated that 6-in. types are good for a resistance of from 21,000 to 24,000 lbs., while the 8-in. types are good for about 34,000 lbs. on subgrades of no less supporting power than those of the test slabs. In all cases the slab resistance was found to depend upon the support offered by the subgrade. The resistance seems to be overcome by the magnitude rather than the repetition of the blows. Considerable variation was shown between the two 6-in. 1:3:6 slabs, but the low resistance and the radial cracks shown in certain sections seem to indicate that they are not so strong as the 1:1.5:3 slabs.

In the tests of monolithic brick sections it was found that the resistance of such pavement is an uncertain quantity, caused by the fact that the slab acts as a monolith up to a certain point, after which it becomes two independent slabs, when a resistance equal only to the sum of the strengths of the two parts can be expected if top and bottom break at the same instant. If, however, the weaker part breaks before the stronger, then a resistance equal only to that of the latter can be expected. Several of these slabs indicated that resistance to horizontal shear was greater than the sum of the resistances of top and base in bending.

With one exception, the semimonolithic brick sections showed less resistance than the monolithic. In general, little relation could be discovered between the resistance and total thickness of the semimonolithic slabs. Their resistance is considered to be possibly affected by the adhesion between the surface and base. Until it is definitely shown that the surface of this type of pavement does not separate from the base, it is considered inadvisable to expect greater resistance than is offered by the sum of the strengths of the base and top.

In the tests of the brick surfaces laid on sand and screening cushions and concrete and macadam bases it was found that little can be expected from this type of construction except the resistance of the stronger part of the slab. Apparently the cushioning effect of a sand bed does not in any way increase the resistance of the pavement. The indications are that the grouted 4-in. brick surfaces are as strong as the 4-in. concrete slabs. Also, in general, the sections with bituminous-filled surfaces apparently show less resistance than similar slabs with grout-filled brick.

In order to obtain additional information for comparative purposes a series of beams representing the various slabs was constructed, and their respective moduli of rupture were determined when subjected to static loads centrally applied. Their depths varied with the type of pavements represented, and they ranged from 12 to 13 in. in breadth. All were 7 ft. in length.

A comparison of the results of the concrete beam tests under static loads and the tests of concrete slabs under impact blows shows that the relation of resistance to thickness is not the same under the two conditions of loading. Beginning with the 4-in. slab the resistance of the slabs, as measured by the equivalent static load at failure, increased 5,000 lbs. with each inch of additional thickness, while the beam resistances varied as the squares of their depths. It is thought that the subgrade influence affected the resistance shown by the thinner slabs much more than that of the thicker. The monolithic slabs in most cases showed less resistance than the 1:1.5:3 concrete slabs of the same depth. The monolithic sections tested as beams under static loads failed in the same way, but the resistance of the beams seemed to be slightly in excess of the sum of the top and bottom strengths, while the slab resistances compared favorably with the sum of the resistances of the two parts. This is taken to indicate that higher shearing stresses are developed by impact than by equivalent static loads.

The results are taken to indicate in general that the resistance of the slab specimens tested increased with an increase in the bearing power of the subgrade. There was apparently no direct relation between the moisture content and the supporting value of the subgrade. The supporting value was least in the early spring after the frost had left the ground, and it increased through the summer months. During the summer the supporting value was not much impaired by rains. The relation between the strength of 1:1.5:3 and 1:3:6 concrete specimens, as shown by both the beam and slab tests, was different from that shown by the compressive tests on cylinders and cubes. From the latter the resistance to compression for 1:3:6 was about 50 per cent of that for the 1:1.5:3 mix, while the difference between the two mixes as indicated by beams and slabs did not exceed from 15 to 20 per cent. A practical application of the test results is given.

Economics of bridge work, J. A. L. WADDELL (*New York: John Wiley & Sons, Inc., 1921, pp. XXXII+512, pls. 5, figs. 72*).—This is a detailed treatise on the economics of bridges, in which the author takes up all phases of the economics of bridge design and construction, and in particular discusses the comparative economics of different types of bridges and structural materials.

The design of windmills, H. BAUDISCH (*Ztschr. Gesam. Turbinenwesen*, 17 (1920), Nos. 11, pp. 125-128; 12, pp. 136-139, figs. 7).—An intricate mathematical analysis of wheel design is given.

A standard belt pulley, C. NYBERG (*Agr. Engin.*, 2 (1921), No. 1, p. 21, fig. 1).—Mathematical and graphic data for the design of belt pulleys are presented. The following formulas are given:

For single leather belts and rubber or canvas belts up to and including 4 ply,

$$A = \sqrt[3]{\frac{DW}{4N}} + \frac{1}{8} \text{ in.}$$

For double leather belts and rubber or canvas belts 5 ply and up,

$$A = \sqrt[3]{\frac{3DW}{8N}} + \frac{1}{8} \text{ in.}$$

In these formulas N=number of spokes, D=diameter of pulley, W=width of belt, and A=the width of arm at hub.

The width of face of pulley= $W + \frac{1}{2}$ in., the thickness of arm at hub= $0.5A$, a is the width of arm at rim= $0.67A$, the thickness of arm at rim= $0.5a$, and the thickness of rim at edge= $\frac{5}{8}$ in. for single belt and $\frac{3}{8}$ in. for double belt.

The graphic data are based on a belt pull of 50 lbs. per inch width for single belts and 75 lbs. for double belts. The working strength of the material from which the pulleys are made is considered to be 2,000 lbs. per square inch.

Farm blacksmithing, J. F. FRIESE (*St. Cloud, Minn.: Author*, 1921, pp. 92, figs. 88).—This is a popular treatise on the subject of farm blacksmithing, and is intended not only as a means for self-instruction in the subject for farmers but as an aid to teachers of farm blacksmithing.

The metallurgist and the tractor, C. S. MOODY (*Jour. Soc. Automotive Engin.*, 9 (1921), No. 3, pp. 189-192).—The author presents a comparison of the different materials available for tractor construction, and considers standard specifications. In regard to metallurgical problems it is pointed out that the first task of the designer is to determine the stresses in the various parts and their magnitude, this necessitating a true appreciation of shock and fatigue. The construction features of the different parts of the tractor are treated in general, and heat treating is considered in detail.

Annealing is used for removing strains, softening material, and for refinement of grain. With regard to heat treatment in general it is stated that gears which carry little stress and wear need no treatment when made of cast iron, mild steel, or bronze. Where there is a large amount of wear and light stresses light steel may be used which is carburized and treated by single or double quenching and then drawn. For extreme wear and high stresses, alloy steel may be used which is carburized and given preliminary heat treatment, double quench, and draw. For high stresses and low wear, alloy steels are used with preliminary heat treatment, single oil quench, and draw. For extreme wear and stress it is thought that a self-hardening alloy steel may be necessary, with even two preliminary heat treatments and an oil or air quench and draw.

An economic study of farm tractors in New York, W. I. MYERS (*New York Cornell Sta. Bul.* 405 (1921), pp. 55-134, figs. 11).—An attempt is made in this bulletin to summarize information drawn from the experience of tractor owners in the agricultural counties of New York. Detailed records were obtained by actual visits to farms in parts of Cayuga, Monroe, and Orleans Counties, and other data were obtained from questionnaires sent to tractor owners in all but seven of the other agricultural counties.

It was found that the average cost of operation of a tractor without an operator for the year 1919 on the farms from which information was obtained

was \$1.16 an hour, and that the average cost of a tractor operator was 50 cts. an hour. The average rate of tractor plowing was 4.8 acres in 10 hours, making the average cost of tractor and operator in plowing \$3.46 an acre. The cost of a tractor plow was estimated at 80 cts. an acre. The average annual cost of tractor operation on these farms in 1919 was \$660 for tractor and operator. The largest single item of cost was depreciation, which amounted to \$187.25 per tractor. Other costs in the order of their importance were tractor operator, fuel, repairs, interest, work on tractor by farm labor, lubricants, automobile use, horse labor, insurance, and use of buildings. The average estimated life of these tractors was six years. The average number of hours worked by them annually was 425, of which 321 were on drawbar and 104 on belt work.

The relative efficiencies of tractor and horses were found to vary in different kinds of work. At heavy work such as plowing and disking a tractor accomplished as much on the average in a day as from seven to nine horses. At harrowing a tractor accomplished as much as six horses, at binding corn or grain as much as from four to five horses, and at mowing as much as three horses. On 46 farms in a general farming region an average of 1.6 less horses per farm were kept after purchasing a tractor, and at the same time the average size of the farms was increased by nearly 17 acres per farm. Less hay and grain were fed to horses after tractors were purchased, partly because of the fewer horses kept and partly because less grain was fed per horse after the purchase of a tractor. Occupants of these farms estimated that on their present farms they need 2.4 fewer horses per farm and four months less of hired labor per farm than would be needed if a tractor were not used.

Data are also presented showing the various kinds of work for which the tractors were used, the kinds and cost of, and the average investment in tractor equipment, the relation of size of farm to tractor use and size of tractor, and the effect of tractor use on other points of farm organization.

Conditions favorable to tractor operation in the State are enumerated in some detail.

Tractors triumph at Fargo tests, H. E. EVERETT (*Chilton Tractor Jour.*, 7 (1921), No. 2, pp. 7-17, figs. 46).—The records of the tractor demonstration held at Fargo, N. Dak., in June, 1921, are presented. The work consisted of plowing and preparing and seeding the land.

Kerosene tractors showed respective average consumptions of kerosene of 3.01 and 1.25 gal., of gasoline of 0.12 and 0.094 gal., and of lubricating oil of 0.11 and 0.04 gal. per acre. Gasoline tractors showed respective average consumptions of gasoline of 2.77 and 1.28 gal. and of lubricating oil of 0.05 and 0.03 gal. per acre.

The kerosene tractors required 0.94 and 0.418 man hours per acre and the gasoline tractors 0.94 and 0.43 man hours per acre of work.

The respective averages of the six best records on fuel consumption were for kerosene 2.51 and 1.01 gal., for gasoline 0.041 and 0.034 gal., and for lubricating oil 0.08 and 0.02 gal. per acre.

The five horse outfits competing showed an average consumption of hay per outfit of 352 lbs., and of oats of 13.85 bu., with an average man labor requirement for plowing of 2.64 hours and for preparing and seeding of 1.43 hours.

Farm dairy houses, E. KELLY and K. E. PARKS (*U. S. Dept. Agr., Farmers' Bul.* 1214 (1921), pp. 14, figs. 9).—Brief popular information is given on the planning and construction of farm dairy houses, including plans for milk houses of various sizes.

Farm poultry buildings, J. G. HALPIN, J. B. HAYES, and O. R. ZEASMAN (*Wisconsin Sta. Bul.* 336 (1921), pp. 31, figs. 18).—Popular information on the

planning and construction of poultry buildings adapted to Wisconsin conditions is presented in this bulletin, together with working drawings and bills of material for certain special types. An unusual feature recommended is a straw loft in the poultry house to prevent the collection of frost on the ceiling. It is necessary to remove the straw in the spring to prevent it from acting as a hiding place for mites.

The silo in Alberta. S. G. CARLYLE and J. McCAIG (*Alberta Dept. Agr. [Pamphlet, 1921], pp. 10, figs. 4*).—Brief popular information is given on the planning and construction of silos adapted to conditions in the Province of Alberta, Canada.

RURAL ECONOMICS AND SOCIOLOGY.

Efficient marketing for agriculture, T. MACKLIN (*New York: Macmillan Co., 1921, pp. XVIII+418, pls. 26, figs. 23*).—This one of a series of social science textbooks, edited by R. T. Ely, analyzes the marketing of agricultural products to distinguish between services, among which are included assembling, grading and standardization, packaging, processing, transporting, storing, financing, and distribution; methods, which are classified as regular, integrated, and direct; and agencies, private, cooperative, and governmental.

In discussing the subject of the market and price making, the author holds that greater efficiency in the marketing system has the effect of increasing production, that the narrower the marketing margin is, consistent with efficiency in rendering market services, and the higher the proportion of the consumer's dollar reaching the farmer, the more certain it is that farmers will produce adequately to meet the needs of the largest possible proportion of consumers.

Prices are made by buyer and seller after reaching satisfactory mutual understanding concerning conditions of supply and demand. Organized markets stabilize by reducing uncertainties. Markets where conditions of extreme scarcity or of oversupply prevail are the consequence of lack of organization, and the remedy is better organization and not abolition of organization. Exchanges instituted by private middlemen have aided in bringing about adjustment of the total supply to the total demand for the entire cycle of production and consumption. Careful investigation and conservative judgment are required to distinguish between integrated marketing systems free from monopoly and those which are strictly monopolies. Prices are said to be determined in the last analysis by calculation, by organized speculation, and by mere guessing, for the first of which organizations do not exist for use for all products. Hence the other methods must be followed until organization is built up.

It is concluded that improvement in the marketing system requires consolidation of the uneconomic middlemen and their plants. Larger income for farmers is said to hinge upon the development and maintenance of working relations between farmers and private or cooperative middlemen to increase the proportion of products of high quality and to educate each farmer to the production of that quantity of a commodity which he can best afford to produce for the price which his organization is able competitively to secure for him. Efficient distributing organizations are urged, as well as the consolidation of agricultural marketing upon the commodity basis, industry-wide, especially in the case of some of the smaller industries.

Those things which may be expected of government service in the improvement of marketing are classified as maintenance of equality of opportunity, securing by investigation or experimentation full facts about marketing, estab-

lishment of minimum standards of competition, enforcement of established standards of competition, and education of the public to a comprehension of the economics of marketing.

Market statistics (*U. S. Dept. Agr. Bul. 982 (1921), pp. 279*).—The statistics of this bulletin, prepared under the direction of C. J. West, assisted by L. B. Flohr, are based primarily upon data relating to farm crops, prices, receipts, shipments, inspections, and other features of the marketing of agricultural products obtained by the Bureau of Markets and Crop Estimates in the conduct of its various reporting and regulatory services. Reports by the Bureau of Foreign and Domestic Commerce, U. S. Department of Commerce, have been drawn upon for statistics for exports and imports, and in some instances material has been taken from recognized commercial sources to complete the tables.

Local cooperative potato marketing in Minnesota, J. D. BLACK, F. ROBOTKA, and P. L. MILLER (*Minnesota Sta. Bul. 195 (1921), pp. 88, figs 6*).—The purpose of this bulletin, prepared in cooperation with the Bureau of Markets, U. S. Department of Agriculture, is to describe the local cooperative potato-marketing organizations operating in Minnesota, explain their business methods, and present the results thus far obtained. The study is limited to associations which are organized primarily for the purpose of marketing potatoes or other vegetables, or which have established potato departments especially for handling such business.

The data were obtained by calling upon the associations at their places of business in the summers of 1919 and 1920. Reports for 1920-1921 were obtained from the records of the Minnesota Potato Exchange and similar sources.

Report of the Federal Trade Commission on the grain trade, I, II, and V, V. MURDOCK ET AL. (*Washington: Govt., 1920, vols. 1, pp. 350, pls. 2, figs. 5; 2, pp. 333, pls. 3, figs. 7; 5, pp. 347, pls. 3, figs. 2*).—Report is made of an inquiry into the processes of carrying grain from the producer to the manufacturing consumer and distributor for wholesale or export. The period covered was approximately 1912 to 1918, inclusive. The grains studied were wheat, corn, oats, rye, and barley.

Volume 1. Country grain marketing.—This volume deals with the functions, age, and distribution of country elevators and warehouses, their physical characteristics, and the development of country elevators and marketing. Methods of purchase and storage, sale and shipment of grain, as well as incidental functions, such as the handling of coal, ice, feed, and other commodities, are set forth.

A study of margins by types of elevators leads to the conclusion that the differences in the buying margins between cooperatives, mills, independent, and line houses are probably not great; that doubt may be expressed whether on the whole the cooperatives or the mills pay the farmer appreciably more for his grain than do the other types; and that, in so far as farmers profit by selling to the cooperatives or farmers' elevator, it is probably due to returns in the form of dividends or stock owned. The factors in variations in margins between elevators, between seasons, and from year to year are accounted for.

Differences in grading, docking, and weighing between country elevators and the State inspection at terminal markets with reference to four Minneapolis commercial line elevators were studied. The returns show that on something less than 25,000,000 bu. of wheat purchased during three years, these four companies sustained a net loss of over \$83,000 on grading, weighing, and docking combined. This included a profit of about \$87,000 on dockage and about \$60,000 on weighing, so that the total loss on grading alone was about \$230,000, or 0.97 ct. per bushel.

It is said to be possible that the profits of the line companies shown on dockage were slightly increased by the sale of certain screenings for which no allowance was made to the farmers. Competition, however, usually forces allowance for this.

Chapters are devoted to the subject of hedging by country elevators, the financing of country warehouses, and competitive conditions in country buying. Tables and miscellaneous information are given in appendixes.

Volume 2. *Terminal grain markets and exchanges*.—The subject matter of this volume is the growth and relative importance of numerous terminal markets and grain exchange associations, functions exercised, and rules prescribed. A brief history is given of transportation development, and its influence on the Chicago and other Boards of Trade is described in detail.

Volume 5. *Future trading operations in grain*.—This volume is intended to describe the technique of future trading operations and facilities or machinery for such trading.

Rules and regulations of the Secretary of Agriculture under the Food Products Inspection Law of March 3, 1921 (*U. S. Dept. Agr., Off. Sec. Circ. 155 (1921), pp. 11*).—These rules and regulations, issued in August, 1921, are to supersede earlier ones (*E. S. R., 43, p. 794*).

Methods of conducting cost of production and farm organization studies, F. W. PECK (*U. S. Dept. Agr. Bul. 994 (1921), pp. 47, figs. 8*).—The uses of cost studies are said to lie in determining the relative profits and economy of various operations, as well as in their educational value for beginning and sub-marginal farmers and in their usefulness as a working basis in an emergency when price fixing might become necessary. Basic elements of cost are the quantity requirements of crops and live stock, such as hours of labor and quantities of feeds and materials that are used in production. Directions are offered as to the principal factors to be kept in mind in presenting the results of investigation, principally from a farm organization standpoint, but also from that of opportunity *v.* operating costs. Methods of obtaining cost data are classified as the accounting method, the survey method, and a combination of the two, and each is set forth in detail.

The cost of production of wheat in a commune in Italy, D. SBROZZI (*Italia Agr., 58 (1921), No. 8, pp. 225-237*).—Costs of wheat production on a certain farm in Romagna near the eastern coast of Italy are recorded, being separated into items including the preparation of the soil, fertilizers, seed, labor for cultivation, harvesting, thrashing, transportation, insurance, taxes, various expenses of management, interest, and value of the elements of fertility extracted from the soil. These figures indicate that a considerable loss was experienced in producing wheat to sell at the price established by the Government. Discussion follows of the question of the advisability of Government encouragement of home production of grain supplies and protection on the home market.

A system of accounting for cotton ginneries, A. V. SWARTHOUT and J. A. BEXELL (*U. S. Dept. Agr. Bul. 985 (1921), pp. 42, pl. 1, figs. 2*).—A system of accounting is described in this bulletin which is expected to meet the needs especially of cotton ginneries as they are operated in the Cotton Belt of the United States. In part 1 the reports the manager needs, which are the balance sheet, income and expense statement, summary of operations, and cost and income analysis, are described and model forms exhibited. Part 2 describes record forms and their use and outlines the way in which the system works. The appendix gives directions as to how to keep the necessary accounts, close the books at the end of the year, and prepare the annual reports.

International yearbook of agricultural legislation (*Inst. Internatl. Agr. [Rome]*, *Ann. Internatl. Lég. Agr.*, 10 (1920), pp. XLVI+862).—This compilation of legislation relating to agriculture in the important governments of the world in 1920 continues information previously noted (E. S. R., 45, p. 293).

Non-partisan League, A. A. BRUCE (*New York: Macmillan Co.*, 1921, pp. VIII+284).—This account of political issues of the last six years in North Dakota represents the Nonpartisan League as originally a farmers' organization, having as its purpose control of the price and marketing of grain, becoming, however, a movement to introduce principles of State socialism.

The political defeat of the movement in 1920 is said to leave yet before the farmers their legitimate economic problem of practical cooperation.

Annual report of Tri-State Development Congress (*Tri-State [Minn.-Wis.-Mich.] Development Cong. Rpt.*, 1 (1921), pp. 100).—Report is made in these pages of the proceedings of the first convention of this body, held at St. Paul, Minn., January 26 and 27, 1921, for conference on problems relating to agricultural development and colonization in Minnesota, Wisconsin, and Michigan.

Community dairy development by the Pettis County plan, C. M. LONG (*Missouri Agr. Col. Ext. Circ.* 103 (1921), pp. 23, figs. 6).—A plan of cooperative purchase of purebred dairy stock as worked out in a community in Missouri is described here.

Denmark, a cooperative commonwealth, F. C. HOWE (*New York: Harcourt, Brace & Co.*, 1921, pp. XI+203).—This is said to be one of a few countries which is using its political agencies for the promotion of the economic well-being, comfort, and cultural life of its people, increasing and controlling the distribution of its wealth.

A brief historical account is given of the industrial and economic revolution and the development of the cooperative movement in agriculture. Popular education and cooperation are said to explain the solid prosperity of Danish agriculture. This has been contributed to also by the fact of the almost universal individual operator ownership of farms.

An account is given of the accomplishment by N. F. S. Grundtvig of a system of adult education through the people's high schools and of its influence on the national agriculture as well as on the attitude of the people. The system of elementary education is also described.

The control of politics is said to be in the hands of farmers, agricultural workers, and the artisans of the city, with the result that the end of landlordism and much advantage to the farmers through social legislation, development of railways, and reform in the system of taxation have been brought about.

Reports of the Belgian Peasants' League, 1919 and 1920, LUYTGAERENS (*Boerenbond Belge Exercice*, 1919, pp. 109; 1920, pp. 140).—Reports of the organization previously noted (E. S. R., 42, p. 791) are continued for later years.

A special report upon the functions and activities of the section on agriculture of the national committee for aid and maintenance of the food supply, E. TIBBAUT (*Rapport Spécial sur le Fonctionnement et les Opérations de la Section Agricole du Comité National de Secours et d'Alimentation*, 1914-1919. Brussels: Govt., 1920, pp. X+467, pl. 1, figs. 26).—Detailed information regarding technical and economic aid to agriculture and the live-stock industry by the Belgian Government in the period of 1914-1919 is included in this report.

The agricultural export industry of Argentina, its development and importance, E. W. SCHMIDT (*Die Agrarische Exportwirtschaft Argentiniens, Ihre Entwicklung und Bedeutung*. Jena: Gustav Fischer, 1920, pp. XV+296).—This is a detailed statistical study based on census returns which represents the composition of the population, the progress of agricultural settlement, the

development of banking and credit available for agriculture, the use of machinery, and the production of grain and live stock for export.

It is pointed out that the nationalities represented among the emigrants to this region between 1857 and 1910 were, in order of importance, Italian, Spanish, French, Russian, Turk, and German. The majority of these emigrants became agricultural laborers or colonists.

Considerable discussion is devoted to the history and progress of State and privately owned railroads, harbors, and steamship lines as affecting the development of agriculture.

A decided general decrease in the number of holdings of 5,000 hectares (12,350 acres) and over is shown in several Provinces in 1911 as compared with 1901. The number of small and medium holdings is shown to be increasing. Tenancy is the predominating system under which the land is cultivated. Between the years 1895 and 1910 the proportion of owner operators decreased from 60.7 to 31.8 per cent and that of tenants rose from 30.6 to 56.1 per cent, while that of half-share renters increased from 8.7 to 12.1 per cent in the important agricultural regions. Between 1904 and 1916 the second class continued to increase, while the other two declined.

Cooperative associations are shown to have been increasing somewhat in membership and working capital, the important ones being the mutual insurance societies. Only in recent years have conditions of agriculture been favorable to development of this kind.

Wheat, corn, and linseed are the important cash crops produced almost exclusively for export. The acreage, production, and average export prices are extensively tabulated. Other industries noted are the production of frozen meats and of dairy and mill products.

Monthly Crop Reporter (*U. S. Dept. Agr., Mo. Crop Rptr.*, 7 (1921), No. 11, pp. 133-144).—This number contains the usual crop summaries, tabulations of crop conditions, and reports on crop production and prices, together with the estimated farm value of important products, average prices received by producers in the United States, and range of prices of agricultural products at important markets. There is included a brief report of a commercial census of the tomato pack of 1918, 1919, and 1920, as well as a special report from the census of 1920 showing the number of farms and percentage of all farms reporting telephones and the use of gas or electric light.

Handbook of foreign agricultural statistics (*U. S. Dept. Agr. Bul.* 987 (1921), pp. 69).—This is a compilation, under the direction of F. Andrews, of official statistics of crops and live stock of 37 important foreign countries and 3 island possessions of the United States, mainly for the years 1910-1920. Foreign reports have been computed to the United States weights and measures.

Live stock and animal products statistics, 1920 (*Canada Bur. Statis., Live Stock and Anim. Prod. Statis.*, 1920, pp. 67).—This is the second of a new series of annual statistical reports, the first of which was previously noted (*E. S. R.*, 45, p. 295).

Area and yields of agriculture in the Republic of Austria for the year 1920, with comparisons (*Anbauflächen und Ernteergebnisse im Gebiete der Republik Österreich im Jahre, 1920. Vienna: Govt.*, 1921, pp. 31).—This statistical report continues information previously noted (*E. S. R.*, 46, p. 92).

[Agricultural statistics of British India] (*Brit. India, Statis. Abs.*, 54 (1910-1919), pp. 128-136).—Summaries of agricultural statistics are given, as previously noted (*E. S. R.*, 43, p. 896).

AGRICULTURAL EDUCATION.

Rural supervision in the United States, K. M. COOK (*Amer. School Bd. Jour.*, 59 (1919), No. 6, pp. 28-30, fig. 1; 60 (1920), Nos. 1, pp. 29, 30, fig. 1; 3, pp. 29, 30).—Prevailing methods of supervision of rural schools are briefly classified. They are the State supervision system, which is followed in relatively few States; regional or division supervision, in which administrative units—counties, townships, or districts—unite for supervisory purposes, either through legal provision and with State aid or entirely by their own efforts; county supervision, in which the supervisory unit may or may not be coterminous with the unit of administration; and township supervision. The last prevails in Massachusetts and other New England States outside of the superintendency unions. The system where the unit of supervision is the county and that of administration the district prevails in about 40 States. This is said to have distinct disadvantages, and State cooperation in supervision as practiced in those States in which special representatives of the State department share the responsibility for the improvement of rural schools is favored as being adapted to all conditions and systems. This is said to be gaining in popularity and efficiency of service.

Qualifications and scholarship of county superintendents or supervisory officers, as well as methods of their selection and tenure of office, are discussed as factors in the progress of rural schools.

Truth about rural schools in New York State, M. SHULER (*Amer. Rev. of Reviews*, 64 (1921), No. 6, pp. 641-644).—A list of 163 questions was sent in 1920 to the women of each of the 11,000 school communities in New York State by the State League of Women Voters, cooperating with the State Department of Education, asking information concerning the general condition of the schools, sanitation, medical inspection, health instruction, physical training, hot lunches, and facilities for play.

It is reported here that three principal remedies for conditions discovered have been planned. The first is a traveling exhibit illustrating one of the worst schools actually existing and contrasting it with a model consolidated school. The second which is proposed is a bill to provide for the consolidation of districts and the improvement of school buildings. The third is the initiation on the part of women's clubs and community leaders of plans for improving equipment and influencing school boards to act.

Rural health v. city health, L. W. RAPEER (*Amer. School Bd. Jour.*, 60 (1920), No. 2, pp. 35, 36, 115).—Information from various investigations and summaries of statistics is briefly reviewed and shown to indicate relatively greater defects among children in the country than in the city. The consolidated rural school is said to be an important factor for the improvement of health conditions, principally by educating communities to carry out health programs and require the services of agencies for general health improvement.

Agriculture and rural industries ([*Gt. Brit.*] *Development Commrs. Rpt.*, 10 (1920), pp. 12-189).—A scheme adopted in 1911 by the Development Commissioners for promoting agricultural research in Great Britain is described, and reports are included dealing with the progress of investigations at 16 institutions in England, Scotland, and Wales, as well as local and special investigations, training of agricultural investigators, farm institutes, and other efforts for the improvement of rural industries and economic conditions.

The station of agronomy of Yonne, E. ROUSSEAU (*La Station Agronomique de l'Yonne [Auxerre]*, 1920, pp. 96, pls. 5, fig. 1).—In this monograph is given an account of the founding of the station in 1874. Its functions are outlined as

including analyses, especially of fertilizers, insecticides, soils, water, wines, food-stuffs, and other agricultural materials, technical and professional advice, agricultural education, scientific research in agriculture, and regulatory work. A list of publications since about 1901 is given with brief notes, and a special study of the work carried on at this station in the war period, 1914-1918, is included, together with a personnel list.

Agricultural education in Denmark, G. H. GARREAD (*Jour. Roy. Agr. Soc. England*, 81 (1920), pp. 63-102, figs. 4).—This article is compiled from information obtained by the author as a member of an official English expedition in Denmark, June 25 to July 25, 1920. It traces the school career of a student from the elementary school through the Royal Agricultural College at Copenhagen. Folk high schools, schools for small holders, agricultural and dairy schools, State agricultural experiment stations, agricultural history museums, and the work of numerous agricultural societies are included in the discussion.

Essays on agriculture, edited by S. D. BABBITT and L. C. WIMBERLY (*Garden City, N. Y.: Doubleday, Page & Co., 1921, pp. XIII+394*).—This collection of essays is intended for use in composition courses in agricultural colleges to serve as examples of effective writing, sources of discussion of principles of English composition, and an inspiration to the student to written expression on problems with which he may be familiar.

The 32 essays are grouped according to thought content in sections called the dignity of farming, the farmer of the present, the farmer as a man of business, the farmer as a scientist, and our forefathers and farming.

The list of authors' names includes ancient Greek, early American, and contemporary writers.

Dairy laboratory exercises on testing and composition of dairy products, H. C. TROY and T. J. MCINERNEY (*Ithaca: N. Y. State Col. Agr., 1921, pp. VI+166, figs. 8*).—The exercises in part 1 of this outline constitute an introductory course on the testing and composition of dairy products. Those in part 2 are intended as an advance course for students specializing in dairy and food control work.

The gateways of commerce, J. FAIRGRIEVE and E. YOUNG (*London: George Philip & Son, Ltd., 1921, pp. VIII+271, figs. 65*).—It is anticipated that this book will appeal to the general reader, and may also be useful as an elementary text or reference in continuation schools offering an introductory course in economic geography. The discussion is developed in order of complexity and also in some geographical order, first giving a general summary, then describing the physical, agricultural, and industrial geography of Great Britain and the surrounding seas. Succeeding chapters refer to world conditions, with special reference to the United States.

Nutrition bibliography (*New York: Amer. Red Cross, Health Serv., 1921, pp. 30*).—This list of references, prepared by the bibliography committee of the New York Nutrition Council, is presented in five sections, the first including technical material dealing with standards of nutrition, growth, and development. The second provides sources of information on methods of determining malnutrition and various studies showing its extent, causes, and effects. The third section lists a number of reports of nutrition work; the fourth covers reference material on health essentials and teaching methods; and the fifth includes stories, plays and pageants, slides, charts and posters, films, and various other graphic methods of teaching health. A list of bibliographies on the subject and a directory of publishers of material cited are included.

A laboratory study of household chemistry, M. E. JONES (*Boston: Allyn & Bacon, 1921, pp. XV+173*).—Fundamental principles of chemistry are set forth in the first half of this laboratory outline, with experiments for illustration made as practical from the point of view of application to household and everyday problems as possible. The last half is given over to an elementary study of organic chemistry applied to fuels and illuminants, food principles, food substitutes and adulterants, textiles, soaps, laundering, bleaching, blueing, dyeing, and leavening agents.

Household arts for home and school, A. M. COOLEY and W. H. SPOHR (*New York: Macmillan Co., 1920, vols. 1, pp. IX+433, pls. 4, figs. 220; 2, pp. VIII+436, pls. 4, figs. 232*).—This textbook is intended for use in elementary schools or junior high schools. Lessons are simply drawn up, and the text is profusely illustrated. Volume 1 is devoted to lessons on the family budget, home furnishings, care of the baby, textiles, sewing, and selection of clothing; volume 2, to the care of the home, selection of food, cooking and serving, laundering, and hospitality.

Vocational home-making education, edited by D. SNEDDEN (*New York: Columbia Univ., Teachers Col., 1921, pp. III+149*).—The material included in this pamphlet, setting forth a few illustrative projects for home-making instruction, is the outcome of the work of 16 students at the summer session of Columbia University for 1919. It is a report of progress in the experimental study of methods and aims in vocational education in home economics and in the State supervision and training of teachers.

A provisional list of home projects on food, clothing, house care, laundry, child care, accounting, sick nursing, housing and furnishing, youth and adult sociability, and care of the garden and yard is drawn up. Five illustrative projects are outlined in considerable detail, and a few miscellaneous ones are noted.

The home project, its use in home-making education, G. FISHER (*Fed. Bd. Vocat. Ed. Bul. 71 (1921), pp. 74*).—Six essentials of a home project are outlined, and suitable types giving opportunity for training in manipulation, planning, and management with reference to activities of the home are suggested. Plans, records, reports, and supervision are discussed and illustrated. The project method as a part of the technical and professional training of teachers is also considered. In the appendix are included reports of home projects from vocational schools and teacher-training institutes, offered as examples of what is now being done toward using the home-project method in home-making instruction.

Grain judging for boys' and girls' clubs, C. E. CARTER (*Missouri Agr. Col. Ext. Circ. 104 (1921), pp. 16, figs. 13*).—"The purpose of this circular for members of grain and soil judging clubs is (1) to teach them to recognize the types and varieties of corn, wheat, and oats; (2) to familiarize them with the score card used for each of these grains; (3) to furnish a brief history and description of some of the most common varieties; and (4) to encourage field selection and proper storage of seed corn."

The demonstration work, O. B. MARTIN (*Boston: Stratford Co., 1921, pp. [10]+269, pls. 19*).—This volume is primarily a tribute to the spirit of service, the foresight, and the talent for organization of Dr. S. A. Knapp, the founder of agricultural extension work. It is furthermore the story of the beginning and development of farm demonstration work, boys' and girls' farm and home clubs, and home demonstration work, with special reference to the Southern States.

Extension work among Negroes, 1920, W. B. MERCIER (*U. S. Dept. Agr., Dept. Circ. 190* (1921), pp. 24, figs. 11).—The early history and development of work among Negro farmers by white demonstration agents, leading to organization under a State leader and with local Negro agents, is presented in this circular, noting also the appointment of field agents and the organization of three divisional conferences in 1920. Results accomplished by farm and home demonstration work, boys' clubs, and miscellaneous campaigns by agricultural agents are reported. A list of the Negro extension workers in the Southern States May 31, 1921, is appended.

MISCELLANEOUS.

A classified list of projects carried on by the agricultural experiment stations, 1920 (*U. S. Dept. Agr., States Relat. Serv. [Pamphlet], 1921, pp. 3+XII+250*).—This is a revision, in multigraphed form, of the list previously noted (*E. S. R.*, 44, p. 1), carrying the projects up quite closely to the end of the calendar year 1920. Of the 4,064 projects of the State stations, 1,468 are in agronomy, 639 in horticulture, 587 in animal husbandry, 344 in diseases of plants, 340 in entomology, 199 in dairying, 164 in veterinary medicine, and 323 miscellaneous.

Thirty-second Annual Report of Kentucky Station, 1919, II (*Kentucky Sta. Rpt. 1919, pt. 2, pp. [3]+372+29-38+III, pls. 4, figs. 12*).—This contains reprints of Bulletins 220-224 and of Circular 23.

Biennial Reports of Missouri State Fruit Experiment Station, 1915-1920, P. EVANS, F. W. FAUROT, ET AL. (*Missouri Fruit Sta. Bien. Rpts. 1915-16, pp. 7; 1917-18, pp. 11; 1919-20, pp. 12, figs. 7*).—These reports contain financial statements for the biennial periods ended December 31, 1916, 1918, and 1920, respectively, and reports of the director and board of trustees for the same periods.

Thirty-third Annual Report of Rhode Island Station, 1920, B. L. HARTWELL (*Rhode Island Sta. Rpt. 1920, pp. 15*).—This report by the director includes experimental work for the most part abstracted elsewhere in this issue.

Bimonthly Bulletin of the Western Washington Substation (*Washington Sta., West. Wash. Sta. Bimo. Bul.*, 9 (1921), No. 5, pp. 65-80).—In addition to articles abstracted elsewhere in this issue, this number contains brief articles entitled Winter Handling of Poultry, by G. R. Shoup; Poultry Yard Sanitation, by W. T. Johnson; The Dairy Herd Sire, by H. E. McNatt; and Farmers' Winter School.

NOTES.

Alaska College.—This institution, authorized by the Territorial Legislature in 1917, is expected to open next September with courses in agriculture, general science, home economics, and mining. An additional Territorial appropriation of \$41,000 for buildings and equipment has been made, supplementing the original grant of \$60,000. The college is to be located near Fairbanks, and Judge Charles E. Bunnell has been appointed president.

California University.—Plans have been completed for the new dairy building at the university farm. This is to be a two-story structure 234 feet long, with a dairy manufacturing wing running back from one end of the main portion for 100 feet additional. The first floor of the main building will include laboratories for butter and market milk, commercial and student testing, farm dairying, and bacteriology, together with a sales room, offices, etc. The second floor will be occupied by three lecture rooms, reading and judging rooms, and office and storage space. The manufacturing wing will house a large creamery laboratory, a milk-receiving room, a student cheese laboratory, refrigeration and ice-making plants, and storage and machinery rooms. A distinctive feature of the building will be the provision for several small units of equipment in each department, making it possible for each student to work independently. This building will cost, exclusive of furnishings and equipment, about \$200,000.

Connecticut College and Stations.—The new women's building at the college is nearing completion. Dormitory accommodations are provided for 100 girls, with additional space for laboratory facilities in home economics for twice that number.

W. L. Slate, jr., agronomist of the college, has been appointed vice-director of the stations, his term to begin July 1.

Florida University and Station.—A cooperative project in the establishment of a citrus bud supply progeny orchard, to be located on the grounds of the Citrus Substation at Lake Alfred, has been agreed upon by the Bureau of Plant Industry, U. S. Department of Agriculture, and the station. Work in connection with this project will include studies in bud variation in the standard commercial orange varieties of Florida.

Dr. W. B. Tisdale, instructor in plant pathology and assistant plant pathologist in the Wisconsin University and Station, has been appointed assistant plant pathologist in the station with headquarters after March 1 at the new tobacco substation at Quincy, Gadsden County.

C. K. McQuarrie, State agent in agricultural extension work and connected with this work since its introduction into Florida, died November 16, 1921.

H. L. Brown has been appointed extension dairyman.

Illinois University.—The new horticultural building, a series of working laboratories to supplement the previous equipment of the horticultural department, is nearing completion. It is a structure 180 by 190 feet, to cost about \$260,000, and to contain a cold storage plant, laboratories for horticultural machinery and pomology, a canning factory, cider and vinegar making equipment, and similar facilities for the handling and preservation of fruits and vegetables.

Construction on the new agricultural building, to cost \$500,000, is to be begun this spring.

Recent appointments include R. L. Donovan as assistant professor of farm organization and management in the extension service, and Florence Justin as assistant in home economics.

Michigan College.—As the beginning of an effort to strengthen the agricultural courses in marketing and business essentials, Dr. J. T. Horner has been appointed associate professor of economics and accounting. A. L. Bibbins, assistant professor of farm crops, has resigned to become secretary of the New York Cooperative Grange League Federation Exchange of Syracuse, N. Y.

Missouri University and Station.—A total of \$1,035,000 has been appropriated and made available for new buildings and equipment. Of this, \$200,000 is for a new agricultural building, \$25,000 for a new beef cattle barn, \$4,000 for finishing the attic of the horticultural building, and \$1,000 for an addition to the dairy building and its equipment. A new chemistry building and a new power house are also included.

Nevada Station.—Studies are being planned of duty of water on special crops in southern Nevada in the vicinity of Las Vegas and near the Boulder Canyon power site. All water so studied is developed by artesian wells and through pumping from wells.

Studies of local food plants of *Eutettix tenella* and of local habits of this insect are also contemplated.

Cornell University.—Dr. H. W. Dye, assistant professor of plant pathology, has accepted a commercial position in Louisville, Ky. J. R. Bechtel, extension professor of vegetable gardening, and Dr. M. D. Leonard, assistant professor of entomology, have also resigned to accept commercial positions.

New York State Station.—A local section of the Society of American Bacteriologists was formed recently at the station, its territory embracing the region including Rochester, Clifton Springs, Syracuse, Ithaca, and Geneva.

Clarence R. Phipps, assistant in research (entomology), resigned December 31, 1921, to accept a similar position with the Missouri Fruit Station, and has been succeeded by S. Willard Harman. T. O. Sprague resigned as assistant in research (horticulture) on the same date on account of ill health.

Martin H. Smith of Geneva has been appointed a member of the board of control, vice Charles C. Sackett, retired. F. H. Hall, formerly editor and librarian for many years, has been appointed assistant in research (horticulture).

Tennessee University.—The department of agricultural education is conducting an educational survey at Farragut. The object is to ascertain the adequacy of the agricultural instruction being offered, the kind of training needed in farm shop work, and the number of boys between 14 and 21 years not now in school, as a basis for instituting part time instruction in agriculture.

The home economics department has been given control of the management of the dormitories, thus greatly extending the opportunities for practice in institutional management.

The tenth annual meeting of the Southern Cattlemen's Association was held at the university February 14-16, with an attendance of about 300. The officers elected for the new year include Dr. Tait Butler of Memphis as president and P. H. Keane of Blacksburg, Va., as secretary-treasurer. The next meeting will be held at Roanoke, Va.

Dr. Moses Jacob, professor of veterinary science and State veterinarian, has also been appointed professor of animal husbandry.

Utah College and Station.—*Science* notes that Dr. M. C. Merrill, head of the department of horticulture, has accepted an appointment as dean of the

college of applied arts and head of the department of horticulture at Brigham Young University, effective July 1.

Washington College and Station.—The first annual live stock day was held March 7, at the Irrigation Substation at Prosser. This marks the termination of a 60-day feeding test of 700 lambs divided into lots of 50 head each. The test has been conducted to compare the feeding value of the first, second, and third cuttings of alfalfa hay; the value of light *v.* heavy grain rations; the value of corn silage and alfalfa hay as compared with alfalfa hay without silage; the value of cottonseed meal; and the value of beet-molasses. Nine hundred additional lambs have been fed at the substation this winter to utilize part of the large crop of alfalfa hay grown there the past season.

E. G. Woodward, head of dairy work in the college and station, has resigned to take up dairy farming in Connecticut, effective March 1. He has been succeeded by E. V. Ellington of the Dairy Division of the U. S. Department of Agriculture, formerly head of the department of dairy husbandry at the University of Idaho.

New York State Institute of Applied Agriculture on Long Island.—The beginning of the winter term on December 5, 1921, was marked by the opening of a new \$80,000 dormitory, the second of the 10 permanent men's dormitories contemplated to be built. The first has been in use since 1916. Architecturally the new structure follows the style adopted for all of the institute buildings, which is a modified colonial executed in brick with cast stone trim. The construction is fireproof throughout, with modern equipment.

The New York State Egg Laying and Poultry Breeding Contest, which is located adjacent to the poultry plant of the institute, entered upon its second year November 1. This contest, which is of three years' duration, is establishing some new precedents, the number of pullets to each pen being 20 in the first year instead of the more usual 10. This gives a greater opportunity for selection of high producers for the second year's breeding, the 12 leading birds in each being retained while 8 go back to the owner.

A recent night-plowing tractor test undertaken for the purpose of establishing a high efficiency standard for the preparation of land resulted in valuable data regarding endurance, lighting, limit of acreage per machine per hour, and many minor details. Observations by Director A. A. Johnson in the famine regions of Russia during the past summer have led him to believe that such tests should be made. The great number of tractors at the institute, which has been made a repository by practically every manufacturer in the country as well as including many foreign makes, makes it possible to do comparative work of this kind here of unusual value.

Miscellaneous.—The Canadian Society of Technical Agriculturists has established a bureau of records for the use of institutions and firms. This will provide an index, based on the society's membership, of the professional agriculturists of the country, as to academic training, experience, etc.

P. J. Wester, for seven years horticulturist and for the last four years agricultural advisor of the Bureau of Agriculture, Philippine Islands, has retired from the Insular Government service under the Osmeña Act and returned to the United States.

Sir David Prain, director of the Royal Botanic Gardens at Kew since 1905, has retired under the age rule, and has been succeeded by Dr. A. W. Hill, assistant director since 1907.

EXPERIMENT STATION RECORD.

VOL. 46.

MARCH, 1922.

No. 4.

An occasion of great moment for all concerned with agriculture was the National Agricultural Conference held in Washington, January 22-27 of this year. Historically it marked a new step, for it was the first conference of the kind ever convened in this country, bringing together representatives from the major farm organizations, State departments of agriculture, the agricultural colleges, and various lines of business closely associated with agriculture. The more than three hundred delegates included many men and women engaged directly in farming and living as farm people.

In an unusual degree the delegates represented the farm problems as viewed from the individual standpoint and the broad relationships of agriculture to the national life. The scope of the conference is indicated by the list of committees, of which there were 12, namely, agriculture and price relations, agricultural credit and insurance, transportation, foreign competition and demand, cost, prices and adjustments, crop and market statistics, marketing of farm products, agricultural research and education, national forest policy, national land policy, farm population and farm home, and coordination of State and Federal legislation.

Naturally there was much in such a conference as this of vital importance to the colleges of agriculture, for it dealt with the status and the needs of the industry for which they stand. Their representatives were conspicuous in the list of delegates and in the membership of the committees, and they were represented on the general program by an address by President R. A. Pearson of Iowa. This dealt with the subject of A National Policy for Agricultural Research, and was a vigorous presentation of the merits and the needs of research considered from a national standpoint.

Dr. Pearson's thesis was that there should be a well-defined national policy in reference to agricultural research, because such research relates to questions of fundamental national importance and the intrinsic value of it to the whole nation has been fully demonstrated. His argument was based on the fact that agriculture is not only our largest industry, furnishing practically all of the materials for food

and clothing and the raw materials for the larger part of the manufacturing industries of the nation, but supplies about half of the gross earnings of the railroads of the country and a consumptive market for nearly half of all the manufactured products sold in American markets.

That President Pearson was well within bounds is indicated by the Census figures which show that the business of agricultural production, not to mention the subsidiary industries, covers nearly 6,500,000 establishments with a total farm area of 955,676,545 acres. If to the estimated value of these farm lands and buildings, amounting to \$66,334,310,000, is added the value of the live stock, implements and machinery on farms, the total investment amounts to \$77,925,989,000, compared with a capital investment in all manufactures of \$44,776,006,000. The farm value of the products, amounting to twenty-five to thirty billion dollars a year, compares with about twenty-five billion dollars added by manufacturing to the value of the raw materials of manufacture. The extent to which industrial prosperity and economic conditions depend on agriculture has been given unusual demonstration the past year.

From an industry which was largely individualistic and looked after itself, agriculture has become a national concern. As long as man lives it must be a permanent industry, and as the population of the world increases it must be increasingly efficient to meet the needs. The great natural resource on which agricultural production depends, namely the soil, must, therefore, be preserved and not used up by successive generations. Prodigality in living off the substance of the earth without regard to future generations has brought about great problems which only research can solve.

Dr. Pearson pointed out that while research has been applied to all phases of human activities from time immemorial, its application to agriculture has been relatively late in development. It came with a growing concern for the future of agriculture and attempts to meet the problems already confronting it. He gave some striking illustrations of its accomplishments, pointing out how different the situation would be to-day if agricultural research had not been maintained. "We know some of the most important varieties of plants and some of the better strains of animals would be missing. Some diseases of animals and food plants would be rampant. Great areas of soil now producing crops would be barren, and the production from still larger areas would be lowered. Farmers would be paying more for their supplies, and some highly effective marketing methods would not be known."

But much as has been accomplished in the past half-century, he declared that "a sound and efficient agriculture calls for more research," pointing out the misfortune that the research agencies of

the country are quite unable to keep pace with the demands which are being made upon them at the present time, and urging that "the experience of the past, the present situation, and a view into the future emphasize the necessity of enlarging the system."

Special emphasis was naturally laid on research as a means of reducing cost of production, providing better distribution of farm products and better methods of marketing. These are all in the interest of the average citizen who buys his supplies, because they will help to keep down the cost of living. At the same time they are in the interest also of farmers because better methods will increase the profits of farming, and they are of interest to the nation as a means of holding our position in the markets of the world. In the competition of the world, involving in many cases cheaper labor and lower living standards, if we are to win we must depend chiefly upon our superior knowledge. "Some other countries have as good natural resources as ours. Sometimes they are even better because of virgin lands. Other countries have as favorable transportation. Most countries have cheaper labor. We must overcome their advantages by our knowledge, which must be developed through research."

He showed by illustrations how by the improvement in machinery, in methods, in more productive strains of crops and animals, and in greater control of disease and other pests, the return has been notably increased and the production cost reduced over what it must otherwise have been. On this broad basis, Dr. Pearson urged that the development of a more comprehensive national policy for agricultural research should not be longer delayed. "It should provide for liberal Federal and State financial support. One strong reason for using public funds to support agricultural research is that the knowledge to be derived should be made available to every farmer throughout the country who wants it. It should never happen in this country that knowledge relating to agricultural production shall be limited in its application to private interests because it was developed at the expense of those interests."

As to what should be comprised in such a national policy, Dr. Pearson placed the appreciation and good will of the public first of all; "until this is given, research will be heavily handicapped. . . . An intelligent appreciation of agricultural research, especially among leaders and public men, a genuine respect for it, an understanding of its importance and its requirements, are the primary essentials in developing an effective national policy." These should be followed, as they naturally will be, by the provision of adequate support; and as was rightly said, a principal requirement as to funds is assurance of a permanent income. This can not be too

strongly emphasized because successful research is a continuous effort. "Without such assurance strong men can not be induced to prepare themselves adequately for research nor can they be retained in this work. Too often it has been necessary to stop important experimental work because of failure to continue appropriations. Losses have been suffered because important projects after being conducted for an extended period of time had to be discontinued with the failure of appropriations before the final results had been secured."

Referring to the funds at present available for the support of research, it was shown that these represent such a small percentage of the interests concerned as to be almost negligible by comparison; relatively, they are a much smaller percentage of the value of output than the amounts so expended by many a manufacturing plant in the interest of its business. The units in the farming business are not sufficiently large to enable them to provide their own individual research agencies, but individual farmers are cooperating with the Department of Agriculture and the State experiment stations in a variety of experiments and investigations.

A strong plea was made for efforts to encourage young men and women who have ability and inclination of the right kind to prepare themselves for agricultural research. Special scholarships and fellowships were advocated to enable such persons to complete their fundamental training, and later assistantships to bring them into helpful contact with older and well trained investigators. Compensation was advocated which would make such positions as attractive as is provided for persons of corresponding ability and service in allied lines of work. Failure in this respect, it was reminded, has resulted in recent years in a change of nearly 80 per cent in the scientific personnel engaged in agricultural research throughout the country.

In this advocacy of special attention to the preparation of a force of investigators and the provision of an attractive career in research, the speaker may have had in mind the measures recently inaugurated in Great Britain. In connection with the repeal of the Corn Production Act, under which prices for cereals had been guaranteed, to stimulate their production during and following the war, Great Britain last year made an added appropriation of £1,000,000 for agricultural education and research. It was argued that this made more definite and substantial provision for the aid of agriculture than continuing the expensive subsidies on cereals. In carrying out the scheme, the funds will be apportioned to the agricultural colleges and research institutions of the country; and in order to attract and retain a corps of talented workers the Ministry of Agriculture has instituted a system of scholarships, graded

positions, and salaries, thus affording a definite career for those entering this field. Research scholarships have been established and a number of traveling fellowships are contemplated to enable study of research methods and results in other countries. The scheme finds an analogy to some extent in the industrial scholarships available at a number of the agricultural colleges in this country, but these have been limited to a relatively few lines and have not applied to some of the branches in which thorough preparation is specially needed.

Dr. Pearson strongly emphasized the importance of agricultural research to the efficiency and success of all other branches of activity for education and general advancement. He deplored the fact that in the chain of effort centering in these colleges, composed of investigation, college education, and extension, research, considering its position and resources, is the weakest link instead of the strongest, and the least able to meet the demands it should care for. In view of this, continued cooperation of the Federal Government with the States in the enlargement of provision for research was strongly urged, since the adequacy of agricultural research is in no sense a matter of local concern but a national problem, and the results are not confined to the boundaries of any locality or State but to a large extent are of widespread application, and in the aggregate the benefits apply to the country as a whole.

Among other essentials of a national policy mentioned were more definite and constructive cooperation by research agencies, better coordination of work between the State experiment stations and this department, and a larger provision for joint effort in the study of comprehensive problems. Such a definition of function and joining of forces, it was urged, would guard against undesirable duplication and would result in better directed efforts. Furthermore, there should be some plan to insure greater continuity, so that projects may be continued without interruption until they are finished or formally set aside. It was also advocated that a national policy should provide for supervision to assure the proper use of public funds, and while it should not enter the details of local administration, it should encourage the types of organization which would be most efficient.

In conclusion of this forceful plea, the conviction was voiced that "agricultural research, if properly developed, will put agriculture on a permanent and profitable basis in the face of ever-increasing obstacles. And this nation with a strong agriculture will continue to furnish its own great commodities which come from the farms, and will profit further from large sales of the surplus in other countries. The time is ripe for stimulating a national policy for agricultural research which will contribute to this great end."

The subject of agricultural education and research also received attention at the Agricultural Conference from the special committee in that field, which included in its membership persons representing a variety of affiliations,—with farming, with agricultural industries, the agricultural press, State and national organizations, the agricultural colleges, and this department. The report of such a committee, therefore, carried unusual weight, representing the attitude of no single class but of the industry broadly.

This committee in its report, which was adopted by the conference, declared that: "The greatest disaster which can come upon a people is the retardation of the development and diffusion of knowledge. America leads in all phases of national life because it has always led in efforts to discover and disseminate knowledge among all the people. This applies with special force to all matters concerning agriculture. The Morrill Act, the Hatch Act, the Adams Act, the Smith-Lever Act, and the Smith-Hughes Act are perhaps the most notable of the long series of Federal statutes testifying to the intention of the American people to maintain their agriculture upon a plane at least equal to, and if possible superior to, that in any other country."

It urged that existing institutions for agricultural research, education and extension should be developed and strengthened, and that their facilities should be directed to the solution of the practical and economic problems of agriculture in all their relations, and in aiding all farmers to apply available knowledge to the solution of their problems individually and collectively. "The new agricultural problems which have come as a result of post-war conditions require early solution. The individual farmer is demanding information. As never before he is now entering the business world through his co-operative organizations. . . . Existing provisions for reducing damage and losses from injurious insects, animal and plant diseases, and other pests should be maintained and developed."

Furthermore, it was advocated that the results of research be published adequately and promptly, for the information of the public and the encouragement of investigators and teachers. Farmers were advised to cultivate a more intimate relationship with their agricultural college and experiment station, this department and their county agents, so that they may secure and utilize to better advantage all available information.

Finally, "the development of agriculture upon an equality with other industries requires first of all equality of educational opportunity for those who dwell in the country as compared with those who live in the cities and villages. Gross inequality now exists and it must be removed."

On the whole, the conference was a strong endorsement of education and research. The expression of a widespread feeling that progress in developing the industry so as to maintain its supremacy, and relief in meeting conditions which had developed, must look in that direction for permanent aid was evidence of the confidence now felt in the educational and research institutions. Much stress was naturally laid on the economic aspects, the more adequate provision of statistics, attention to marketing and distribution, study of world conditions, and consideration for the interests of the business of farming. But it was made evident that in taking up some of these newer aspects for study there can be no relaxation in attention to the production side. Economic theory has not yet been given the amount of intensive study it must receive to meet the present expectations and serve as a guide in the larger sense. While such study is of a different kind from the experimental method employed with plants and animals, there is no reason why it may not seek out and disclose the relations between cause and effect, and thus enable prophesy and generalization from known conditions on a more secure basis.

Hon. Sydney Anderson, chairman of the Joint Congressional Commission of Agricultural Inquiry, who presided over the conference, in introducing President Pearson expressed keen appreciation of the importance of research in a program of agricultural development; and in commenting upon its value he said that where there had been improvement in the methods and security of production back of it would be found to lie a line of research, not applied at once perhaps, but a potential force which came into use as conditions made ready for it. Perhaps no single event has done more to propagate this conception, and the view that biologically and historically we can not stand still—that research must grow or decay will follow.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

An investigation of the seed of the silver maple (*Acer saccharinum*), I—III, R. J. ANDERSON (*New York State Sta. Tech. Bul.* 81 (1921), pp. 3–20).—This bulletin, prepared with the collaboration of W. L. Kulp, consists of three papers, as follows:

I. *Analysis and composition of maple seed* (pp. 4–7).—Previously noted from another source (E. S. R., 39, p. 366).

II. *Occurrence of inosite hexaphosphoric acid in maple seed* (pp. 8–12).—Previously noted from another source (E. S. R., 44, p. 410).

III. *Acerin, the principal globulin in maple seed* (pp. 13–20).—In this paper the author describes the isolation, purification, and chemical analysis of the globulin of the seed of the silver maple which has been named acerin.

The average composition of acerin is reported as C, 51.44; H, 6.80; N, 18.34; S, 0.55; and O, 22.87 per cent. The nitrogen distribution consists of amid nitrogen 2.53, humin nitrogen 0.15, basic nitrogen 4.86, and nonbasic nitrogen 10.63 per cent. The distribution of the basic amino acids is cystin 0.55, arginin 10.07, histidin 1.43, and lysin 6.07 per cent.

Acerin: The globulin of the maple seed (*Acer saccharinum*), R. J. ANDERSON (*Jour. Biol. Chem.*, 48 (1921), No. 1, pp. 23–32).—Noted above.

Preparation of galactose, E. P. CLARK (*Sugar [New York]*, 23 (1921), No. 11, p. 594).—Previously noted from another source (E. S. R., 46, p. 10).

A report on the Zamia starch situation, J. F. CLEVINGER (*Jour. Amer. Pharm. Assoc.*, 10 (1921), No. 11, pp. 837–840, fig. 1).—This contribution from the Bureau of Chemistry, U. S. Department of Agriculture, consists of a botanical description of the *Zamia* plant, *Z. floridana*, analyses of the rhizomes, and a discussion of the cultivation of the plant, preparation of starch, and present status of the starch industry. The rhizomes were found to have the following composition: Moisture 7.73 per cent, ash 5.01, ether extract 0.63, protein (N×6.25) 6.17, crude fiber 9.23, and nitrogen-free extract 71.23 per cent. Determinations of starch by the diastase method showed a content of 37.75 per cent.

The chemistry of essential oils and artificial perfumes.—I, **Monographs on essential oils**, E. J. PARRY (*London: Scott, Greenwood & Son; New York: D. Van Nostrand Co.*, 1921, 4. ed., rev. and enl., vol. 1, pp. VIII+549, figs. 52).—In this revision of volume 1 of the previously noted reference book on essential oils (E. S. R., 42, p. 8) all work of importance to the end of 1920 has been included.

Notes on the organic acids of *Pyrus coronaria*, *Rhus glabra*, and *Acer saccharum*, C. E. SANDO and H. H. BARTLETT (*Jour. Agr. Research [U. S.]*, 22 (1921), No. 4, pp. 221–229).—Miscellaneous notes on the isolation and identification of the organic acids of the fruit of the American crab apple (*P. coronaria*), the pericarp of the smooth sumac (*R. glabra*), and of the product known as “maple sand,” which is formed as a granular deposit during the process of

boiling down sap of the sugar maple, are reported, with the following conclusions:

"The acid of the sour fruit of the wild American crab apple, *P. coronaria*, is malic acid. When the fruit undergoes autolysis under anaerobic conditions, in the presence of chloroform and toluol, this acid appears to be transformed largely into succinic acid. Further experiments, however, will have to be made in order to repeat the observations and to determine the exact process involved.

"The acid of the outer part of the red fruit of the smooth sumac, *R. glabra*, is malic acid, occurring in the form of the acid calcium salt. With it is associated a considerable quantity of free gallic acid. Malic acid is present in the form of calcium salts (both acid and normal) in maple sap. The product known as 'maple sand' obtained from the evaporating pans is crude calcium malate."

The thermostability of the co-enzyme and its differentiation from yeast vitamin B. T. THOLIN (*Hoppe-Seyler's Ztschr. Physiol. Chem.*, 115 (1921), No. 5-6, pp. 235-256).—In this combined study of the co-enzymes and vitamins of yeast, the author used as the foundation yeast material finely pulverized dried yeast of constant fermenting power. This was rendered inactive by shaking a mixture of 1 gm. of the yeast and 50 cc. of the water for one and one-half hours in a shaking machine and centrifuging for 10 minutes at 1,700 revolutions per minute, after which the opalescent liquid was decanted and the treatment repeated. The resulting yeast was almost completely inactive when tested with 5 per cent glucose solution.

The co-enzyme preparation was made by adding a suspension of 150 gm. of pulverized dried yeast in 300 cc. of water to 1,200 cc. of boiling water, heating the mixture to boiling, and filtering after 2 minutes. The filtrate was concentrated in a vacuum at 25° C. to a volume of 50 cc. and the extract precipitated with 96 per cent alcohol. The precipitate, which consisted principally of proteins, higher carbohydrates, and phosphates, had no co-enzyme activity. The filtrate, which contained all the co-enzyme, was treated with 300 cc. pure acetone. The yellowish-white milky precipitate formed yielded on trituration with absolute alcohol a yellowish-white sandy hygroscopic powder rich in co-enzyme. The powder was easily soluble in water, forming a clear light yellow solution with an acid reaction (pH=5.6). On analysis it gave an ash content of 26.3 per cent and P₂O₅ content of 14 per cent calculated on the dry basis. The substance could be further purified by adding to the water solution lead acetate, filtering, and adding acetone to the filtrate after removing the excess of lead with hydrogen sulphid. On further precipitation with lead acetate and magnesia mixture a precipitate was formed, showing the persistence with which the phosphoric acid clings to the co-enzyme. The author is of the opinion that the function of the co-enzyme in alcoholic fermentation is intimately bound up in the phosphoric acid and also that the co-enzyme is of the nature of an ester.

In describing the preparation of the vitamin, attention is called to the similarity between the method described above and the method described by Osborne and Wakeman (*E. S. R.*, 42, p. 314) for the preparation of vitamin B from yeast, thus showing that the vitamin is present in the co-enzyme preparation. The essential difference in preparation of the co-enzyme and the vitamin in the present study is that in the latter case the material was sterilized by boiling for 45 minutes or more at 100° before precipitation. Other materials used in the study were a 20 per cent glucose solution sterilized for 2 hours at 100° and a solution of NaH₂PO₄ of an H-ion concentration of pH=5.1. The basal solution employed consisted of 1 gm. of washed yeast, 5 cc. of the phosphate solution, and 10 cc. of the glucose solution, the whole made to a volume of

20 cc. To this was added the material to be tested for co-enzyme or vitamin and the amount of carbon dioxide evolved in a given time determined.

The thermostability of the co-enzyme preparation was found to be a function of the temperature and the acidity. At 96° and an acidity of pH=5.6, the co-enzyme activity was destroyed to the extent of 50 per cent in one hour, and at 100° in 37 minutes. While the co-enzyme was thus destroyed by heat, the vitamin preparations from yeast and cabbage were active even after heating for an hour at 107 and 127°. The essential difference between co-enzyme and the vitamin preparations is thus shown to be the difference in thermostability.

Chemical disinfection and sterilization, S. and E. K. RIDEAL (*London: Edward Arnold & Co., 1921 pp. VII+313*).—This is a compilation of information from many sources on methods of chemical disinfection as applied to the disinfection of air, food, water, rooms, furniture, etc.; personal and internal disinfection; destruction of nonbacterial parasites; and wood preservation. This is followed by several chapters on the chemistry of the various organic and inorganic substances used as disinfectants, with a final chapter on methods of analysis and testing of disinfectants. Extensive references to the original literature are given in footnotes and as bibliographies appended to each chapter.

Analytical chemistry.—I, Qualitative analysis, F. P. TREADWELL, trans. and rev. by W. T. HALL (*New York: John Wiley & Sons, Inc.; London: Chapman & Hall, Ltd., 1921, 5. ed., rev., vol. 1, pp. XVII+597, pl. 1, figs. 26*).—This is the fifth revised and enlarged English edition of volume 1 of this well-known book, an earlier German edition of which has been previously noted (E. S. R., 32, p. 501).

A new reaction of ammonia, C. D. ZENGHELIS (*Compt. Rend. Acad. Sci. [Paris], 173 (1921), No. 3, pp. 153-155*).—For detecting traces of ammonia the author suggests the reaction between formaldehyde and an ammoniacal solution of silver nitrate with the formation of a silver mirror. The reagent used for the test is composed of 1 part of a 20 per cent solution of silver nitrate and 3 parts of commercial formalin. When a few drops of this reagent and a few drops of the solution to be tested are placed on a watch glass and covered with a small crystallizing dish, a brilliant silver mirror is formed on the latter in a few seconds if the solution contains ammonia.

The determination of calcium and magnesium in different saline media.—II, Determination of calcium in the presence of magnesium, E. CANALS (*Bul. Soc. Chim. France, 4. ser., 30 (1921), No. 3, pp. 152-158*).—Continuing the study previously noted (E. S. R., 42, p. 710), data are presented showing that calcium can be determined quantitatively as the oxalate in the presence of magnesium in ammoniacal or acid solutions, provided the precipitate is thoroughly washed with boiling water until the wash water no longer decolorizes two or three drops of a 1:1,000 solution of potassium permanganate in sulphuric acid.

Determination of available lime in quicklime and hydrated lime, A. I. WHITSON (*Chem. and Metall. Engin., 25 (1921), No. 16, p. 740*).—With slight modifications the Scaife method for determining free calcium oxid in lime, as described by Meade (E. S. R., 38, p. 804), has been found to give results agreeing within reasonable limits and closely approximating the calculated values. The principal change in technique consists in using for the second heating a 1-liter graduated flask carrying a one-hole stopper fitted with a short glass tube drawn out to a point.

A short test for easily soluble phosphate in soils, O. M. SHEDD (*Soil Sci., 11 (1921), No. 2, pp. 111-122*).—In the abstract of the method of determining

easily soluble phosphate previously described (E. S. R., 45, p. 412) the directions should be corrected to read $N/5$ instead of $N/50$ HNO_3 .

Possible losses in chlorin through ashing and their prevention in chlorin determinations in organic substances, A. WEITZEL (*Arb. Reichsgesundheitsamt.*, 52 (1920), No. 4, pp. 635-649).—A comparison of various methods of determining chlorin in organic materials after decomposition by the wet method or by various methods of ashing is reported. The author is of the opinion that with proper care in ashing as accurate results may be obtained as with the wet method. Of the methods tested, ashing of the material after mixing it with 25 per cent of its weight of slaked lime and sufficient water to make a paste, and ashing with a mixture of soda and saltpeter are thought to be the most accurate.

Adulteration of canned spinach with beet leaves, E. COLLIN and L. GOBERT (*Ann. Falsif.*, 14 (1921), No. 149-150, pp. 100-104, figs. 4).—The principal macroscopic and microscopic differences between beet and spinach leaves are described for the purpose of detecting the former as an adulterant of canned spinach. The most characteristic feature distinguishing the two is a crystalline form of calcium oxalate found in some of the cells of the beet but not of the spinach leaves.

The Bömer method for the detection of suet in lard, II, VITOUX and C. F. MUTTELET (*Ann. Falsif.*, 14 (1921), No. 149-150, pp. 86-92).—The method previously noted (E. S. R., 45, p. 315) has been tested on mixtures of pure lard with various other fats including beef suet, oleomargarins, mutton tallow, and hydrogenated fish oils. In place of the original expression $2G-A$, $G+D$ is used, D representing the difference $G-A$. The result is denoted by Σ . With pure lard from one part only of the animal the value of Σ is 68 or over.

In the examination of various mixtures of fats the method was found to be capable of detecting the presence in lard of mutton or beef fat or of hydrogenated fish oils in amounts as small as 5 per cent of the mixture. With fats containing a low proportion of solid glycerids, such as horse fat and oleomargarins, amounts under 20 or 30 per cent can not be detected.

Determination of lactose in the presence of other reducing sugars.—Application to altered milk and to sweetened condensed milk, L. LE GRAND (*Ann. Falsif.*, 14 (1921), No. 151, pp. 132-136, fig. 1).—For determining the amount of lactose in the presence of other reducing sugars, the author determines quantitatively the amount of monosaccharids by reduction of Barfoed's solution and the total reducing sugars by the reduction of Fehling's solution, the difference between the two representing the amount of lactose. For the quantitative determination of the cuprous oxid Bertrand's method of dissolving the precipitate in ferric sulphate and titrating with permanganate is used. The method is thought to be of value in the examination of milk preserved with bichromate and of sweetened condensed milk, the latter to determine whether through defects in the process there is too great an inversion of the sugar.

A rapid assay method for the determination of ascaridole in oil of chenopodium, E. K. NELSON (*Jour. Amer. Pharm. Assoc.*, 10 (1921), No. 11, pp. 836, 837).—The method proposed, which depends on the fact that ascaridole is soluble in a mixture of 60 parts by volume of glacial acetic acid with 40 parts of water, consists in agitating 10 cc. of the oil with 60 per cent acetic acid in a cassia flask, the neck of which holds 10 cc. graduated in tenths. The flask is then filled to the mark with 60 per cent acetic acid and the mixture allowed to settle, or carefully centrifuged. The volume of undissolved oil subtracted from 10 and multiplied by 10 gives the volume percentage of the ascaridole.

Nephelometric determination of bacterial emulsions, H. HECKSCHER (*Compt. Rend. Soc. Biol. [Paris]*, 85 (1921), No. 26, pp. 378-381, fig. 1).—As standards for the nephelometric measurement of the turbidity of bacterial suspensions, the author uses a series of bacterial emulsions prepared by diluting with a solution of sodium chlorid and formalin (0.5 per cent NaCl and 2 per cent formalin) a 24-hour bouillon culture of colon bacilli to a concentration of 350 million bacilli per cubic centimeter, as determined by bacterial count, and making further dilutions of this standard emulsion in 2-cc. tubes, each tube containing 80 per cent of the number of bacteria in the preceding tube.

To determine the number of organisms in a given emulsion a tube containing the same volume as the standard tubes is placed in the central compartment of a specially constructed box which allows parallel light to pass through the tubes. Two consecutive standard tubes are then placed one on either side of the unknown and changed until one appears slightly less dense and the other more dense than the unknown. By interpolation the density and resulting number of bacteria in the unknown solution are calculated.

Invertase in sirup manufacture, T. S. HARDING (*Sugar [New York]*, 23 (1921), No. 11, pp. 599, 600).—This paper discusses the uses of invertase in the manufacture of cane sirup, as described by Dale and Hudson (*E. S. R.*, 45, p. 317), and in the manufacture of pure invert sugar from sucrose.

The question of the loss of sugar through the presence of fine grain in the final molasses, J. DÉDEK (*Internatl. Sugar Jour.*, 23 (1921), No. 270, pp. 327-330, figs. 2).—The author has modified the Kalshoven technique for determining grain in molasses (*E. S. R.*, 43, p. 508) by heating the solution under examination in a specially constructed autoclave to dissolve the grains after the first refractometric reading. The calculation is then made according to the usual formulas. An illustration is given of the autoclave used, and of a special lighting arrangement for the refractometer.

Results of the determination by this method of fine grain in different samples of molasses from raw sugar manufactured during one season at the Sugar Experiment Station, Prague, gave an average of 6.9 per cent of grain.

Sorghum juice, E. H. JENKINS (*Connecticut Sta. Bul.* 231 (1921), p. 352).—A single analysis of juice obtained from Early Amber sorghum is reported with the following results: Sucrose, 7.35 per cent; invert sugar, 3.29; undetermined solids, 1.87; and total solids, 12.51 per cent.

The distillation of stumpwood and logging waste of western yellow pine, M. G. DONK, C. H. SHATTUCK, and W. D. MARSHALL (*U. S. Dept. Agr. Bul.* 1003 (1921), pp. 13-69, figs. 6).—This is the report of an investigation, conducted jointly by the Bureau of Chemistry of this Department and the department of forestry of the University of Idaho, to determine the nature and value of the products of destructive distillation of logging and land clearing waste, particularly the yellow-pine stumps of that region, the object of the work from an agricultural standpoint being to determine the practicability of reducing cut-over land clearing costs through recovery of by-products from the stumps.

Samples were taken from four acres in different parts of the State by blasting out the stumps, separating the heartwood, and grading it as rich, medium, and poor, depending upon the amount of resin exudation noted when cut into with an ax. Representative samples in charges of from 150 to 200 lbs. were then distilled in a retort provided with a coil system through which high flash cylinder oil of the desired temperature was circulated. During the first stage of the distillation the temperature of the oil was held at 260° C. until the turpentine had been removed. The temperature was then raised to 343° C. at which temperature destructive distillation took place.

The products obtained by this method consisted of crude first turpentine, crude second turpentine, light oil, heavy oil, pyroligneous acid, pitch, and charcoal. Of these products, the turpentines on refining yielded a product consisting mostly of β -pinene and limonene, having a higher boiling point than similar turpentine from southern long-leaf yellow pine and drying more slowly. It has, however, as great a solvent power as that obtained from the long-leaf pine and is thought to be suitable for many if not all of the purposes for which wood turpentine is employed.

The refined pine oil and the crude light and heavy oils are thought to offer promise as flotation oils. The crude light and heavy oils, on account of their germicidal properties which are approximately half as great as phenol, may be used as shingle stains, wood preservatives, vermin killers, and disinfectants. The pyroligneous acid and the charcoal are of inferior quality. The pitch, while blacker and somewhat softer than the North Carolina pitch, is thought to be equally valuable. From the data given on the cost of recovery of these various products, together with the cost of obtaining the original material, it is concluded that "the only wastes from western yellow-pine logging suitable for profitable distillation on a commercial scale are those resinous stumps which contain at least 50 per cent or more of resinous heartwood, and the resinous heartwood of stumps, dead, down wood, and limbs from which the sapwood has rotted away. . . .

" 'Rich' stumps, containing not less than 60 per cent of very resinous heartwood, probably can be profitably distilled in a commercial plant where the stand of such stumps is dense enough to keep a plant supplied for a number of years.

"Owing to the fact that there is a well-developed market in the West for crude pine wood oils for use in the flotation concentration of ores, and also to the small volume of 'rich' wood obtainable within hauling distance, it is probable that single retort plants, which can be dismantled and moved when necessary, are the most suitable for wood distillation in that section of the country, especially in regions remote from the railroad. Such plants might be owned and operated jointly by a number of settlers.

" 'Medium' grade stumps, though much more plentiful than 'rich' stumps, could be used in a commercial plant only at a cost, delivered, materially less than the calculated cost per cord of such wood, \$8.37, and at prices for products not materially less than those given in this bulletin."

In the course of the investigation a simple process for refining crude turpentine was developed which was found to yield a superior product. The essential feature of the process is the preliminary distillation of the crude turpentine under a reflux condenser with sodium hydroxid in the proportion of 75 cc. of 20 per cent of NaOH solution to 500 cc. of the crude turpentine. The reflux condenser is then replaced with a Hempel distilling column and a condenser in the ordinary position, and the distillation continued with steam, the distillate being collected in three fractions—(1) to a ratio of oil to water of 4:6, (2) to a ratio of 3:7, and (3) to a point at which the oil constitutes but 5 per cent of the distillate.

Information on the distribution of western yellow pine contained in pages 1-13 of this bulletin is noted on page 341 of this issue.

Practical leather manufacture, edited by H. G. CROCKETT (*London: Leather Trades Pub. Co., Ltd., 1921, pp. X+398*).—This handbook of modern processes of leather tanning, dressing, dyeing, staining, and finishing is essentially a compilation of original articles from *The Leather World*. The subject matter is treated in sections on heavy leather; harness, saddlery, belting, etc.; upper leathers; light and fancy leathers; and technical information.

METEOROLOGY.

Composite temperature types of the United States, R. DEC. WARD (*Geogr. Rev.*, 12 (1922), No. 1, pp. 116-125, figs. 12).—This is the eighth of a series of articles by the same author on the climatology of the United States (E. S. R., 44, p. 208). Diagrams of composite curves used by the author in his course of instruction in climatology at Harvard University are given, and their use is explained. These curves show "the annual march of temperature as illustrated by the mean monthly values summarized for a group of stations in the same general region or climatic province. . . . Familiarity with these fundamental curves enables anyone to answer reasonable questions regarding the march of temperature in any part of the United States and also to name the climatic province in which an unknown station whose monthly temperatures are given is situated."

The evolution of climate in northwest Europe, C. E. P. BROOKS (*Quart. Jour. Roy. Met. Soc. [London]*, 47 (1921), No. 199, pp. 173-194, figs. 11; *rev. in Geogr. Rev.*, 12 (1922), No. 1, pp. 126-130).—This is a summary of the various phases of the main climatic pulsations in northwest Europe from the height of the glacial period to 300 A. D.

Discussing corresponding climatic changes in North America the author says: "On the whole it appears that though there is a general similarity in the climatic history of the two sides of the North Atlantic, the changes are not really contemporaneous, and such relationship as appears is due mainly to the natural similarity in the geographical history of two regions both recovering from an Ice Age, and only very partially to world-wide pulsations of climate. . . . When we turn to the northwest of North America this is brought out very markedly."

Meteorological records [at the Montana Station], E. BURKE (*Montana Sta. Rpt.* 1920, pp. 46-49).—Records of observations during 1920 at Bozeman, Mont., on pressure, temperature, precipitation, evaporation, sunshine, and wind are summarized in tables.

The mean temperature for the year was 40.5° F., the highest 93° July 21, the lowest -26° March 6. The total rainfall was 19.28 in., the total snowfall 71.5 in. The last killing frost in spring occurred May 26, the first in the fall September 25. The number of clear days was 139; days with 0.01 in. or more precipitation 128.

"Climatic conditions conformed more nearly to normal during 1920 than for several previous years, indicating that perhaps the dry cycle was completed."

The character of the meteorological year 1920-21, A. ANGOT (*Compt. Rend. Acad. Agr. France*, 7 (1921), No. 40, pp. 870-872).—This is a brief summary of meteorological conditions during the year ended November 30, 1921, especially with regard to temperature, precipitation, and wind. It is shown that in the region of Paris the year 1921 was extremely hot and the rainfall below normal, with a prevalence of dry winds from the northeast and a deficiency of the usual moist winds from the south and southwest.

Rainfall records at Rothamsted, W. D. CHRISTMAS (*Nature [London]*, 108 (1921), No. 2714, p. 307).—Data for rainfall and for percolation through lysimeters of different depths are given. The average rainfall for the last 50 years was 29.5 in., and the percolation through 20, 40, and 60 in. of soil was 14.834, 15.482, and 14.659 in., respectively. For the year ended August 31, 1921, the rainfall was 16.282 in., and the percolation through 20, 40, and 60 in. of soil was 6.921, 7.161, and 6.812 in., respectively. "The rainfall for the period September 1,

1920, to August 31, 1921, is the lowest since the records started in 1852, the previous lowest being 19.504 in. in 1897-98. The highest figures for the period are 41.048 in. in 1878-79."

SOILS—FERTILIZERS.

Soils (*Missouri Sta. Bul. 189 (1921), pp. 50-55, 57, figs. 4*).—Experiments by M. F. Miller, F. L. Duley, and O. B. Price to determine the best systems of soil management for the most important soil types in Missouri, consisting of a field comparison of different fertilizer materials, manures, and lime, showed that manure and soluble phosphates gave the best returns of any of the soil treatments, the former being the most beneficial to corn and the latter to wheat, oats, and clover. Potash and limestone gave only small returns.

Studies by Miller and Duley on the relative values of different forms of phosphorus upon the soils at the station and with various crops showed that calcined phosphates gave the best results, followed in order by acid phosphates and basic slag. A 2-year study comparing the use of acid phosphate alone and acid phosphate combined with small amounts of ammonia and potash on wheat showed that acid phosphate gave very striking returns on this soil, which is rather low in organic matter. The addition of 2 per cent of ammonia with the acid phosphate gave an increase sufficient to a little more than pay for the extra treatment. The addition of 2 per cent of potash to the combination of acid phosphate and ammonia resulted in a further increase, sufficient to a little more than pay the extra cost.

Studies by Miller and Duley on the rate of accumulation of nitrogen and carbon in soil under different systems of green manuring and cropping indicated that there is a greater loss of nitrogen from organic matter which is allowed to decay on the surface of the ground than from that which is plowed under or worked into the soil. Studies on water absorption, run-off, percolation, evaporation, capillary water movement, and soil erosion under field conditions showed at the end of the fourth year that land which had been plowed 4 in. deep in the spring and fallowed during the remainder of the year lost over 1 in. of the surface soil by erosion. Land in corn every year lost about 0.5 in., while land in sod lost only 0.01 in. An average of four years showed that over half of the soil eroded during the year was lost during the months of August and September.

Studies by W. A. Albrecht on the longevity of *Bacillus radicolica* in the soil are reported. Samples of two different soils on which soy beans and red clover had grown with plenty of nodules were left out of doors and protected from contamination. Others were dried in the sunlight and some in the dark and later stored so as to be free from chance contamination. It was found that even though the soil may have dried in the sun, there were enough viable bacteria to produce good infection. Drying in the sunlight and storing in the dry state for three years seemed to have no seriously injurious effect on the inoculating power of the soil as compared to a soil left in its natural condition out of doors.

Studies by Albrecht on the effect of different long-continued soil treatments upon bacterial activity in the soil, in which nitrification on plats cropped continuously to corn and timothy with and without manure was determined, showed that nitrate production in the manured and unmanured soils was increased by the addition of limestone. Both soils retained the power to produce nitrates from fresh organic matter, but this power was much increased by the addition of limestone. The rate of nitrate production in the corn plats remained low both on manured and unmanured soils when compared to timothy plats under similar treatment.

Peoria County soils, J. G. MOSIER, S. V. HOLT, E. VAN ALSTINE, and F. W. GARRETT (*Illinois Sta. Soil Rpt. 19 (1921), pp. 57, pls. 2, figs. 8*).—This survey

deals with the soils of an area of 397,184 acres in northwest central Illinois, and reports analyses and field studies of the fertility requirements and crop adaptations of the prevailing soil types.

The topography in general is said to vary from flat to slightly rolling in the northern and northwestern parts to hilly along the Illinois River and Kickapoo Creek. The entire county lies in the basin of the Illinois River, but the northwestern part is drained by Spoon River, while Kickapoo Creek drains the larger part of the remainder of the county.

The soils are grouped as upland prairie, upland timber, terrace, old swamp, and bottom lands, and late swamp and bottom lands, the first two covering over 80 per cent of the area. The most extensive soil types are the brown silt loam prairie soil and the yellow-gray silt loam and yellow silt loam timber soils, which cover 33.64, 20.65, and 27.81 per cent of the area, respectively. It is shown that the more important soils and subsoils of the county are prevailingly rich in potassium but relatively deficient in phosphorus, nitrogen, and lime.

Soil survey of Simpson County, Miss., F. Z. HUTTON ET AL. (*U. S. Dept. Agr. Adv. Sheets Field Oper. Bur. Soils, 1919, pp. 34, fig. 1, map 1*).—This survey, made in cooperation with the Mississippi Geological Survey, deals with the soils of an area of 362,880 acres lying in the Coastal Plain in southern Mississippi. The topography is rolling to strongly rolling, with slopes in places too steep for cultivation. Drainage is said to be well established.

The upland soils are of sedimentary origin, and comprise from 75 to 80 per cent of the total area. Twenty soil types of 12 series are mapped, of which the Ruston very fine sandy loam, Orangeburg fine sandy loam, and Ruston fine sandy loam cover 30.4, 25.9, and 10.5 per cent of the area, respectively.

[Infertile soils], E. BURKE (*Montana Sta. Rpt. 1920, p. 27*).—Pot experiments with soils not producing normal crops showed that some of the soils of the State are lacking in one or more of the elements nitrogen, calcium, and phosphorus. Field studies showed that the major portion of the soils examined contained enough alkali salts to retard plant growth. A study of the mineral salts present in the seepage waters of Gallatin Valley showed a wide variation of mineral salts.

The alluvial soils of Fiji, C. H. WRIGHT (*Fiji Dept. Agr. Bul. 11 (1919), pp. 12*).—Mechanical and chemical analyses of a number of samples of typical alluvial soils of Fiji are reported and discussed. It is stated that this class of soil is under cultivation more than any other in Fiji.

The analyses indicate a wide variation in mechanical composition from one river flat to another, and also a certain amount of variation on each river flat. As a rule the more uniform the surface of a flat, the more uniform is the soil. These soils were very similar in chemical composition, and the slight deviations from the mean values could not be correlated with the crop-producing capacities or their field behavior. A close relationship was found to exist between the percentage of nitrogen and the loss on ignition. The lime-magnesia ratio varied considerably and on the average was less than 1. With one exception all of the soils examined were acid to litmus.

The determinations of the phosphoric acid soluble in 1 per cent citric acid solution in 20 soils showed a mean value of 0.026 per cent. Deficiencies in phosphoric acid accompanied poor yields in cane, and vice versa.

Rubber, banana, and sugar-cane soils are also briefly discussed.

Magnesia impregnated soils, G. N. BLACKSHAW (*So. African Jour. Sci., 17 (1921), No. 2, pp. 171-178*).—Studies of certain soils occurring on the so-called Great Dyke in southern Rhodesia, and which appeared to be unproductive, are reported. The soils comprise red, chocolate, and black loams, and apparently possess a considerable reserve of fertility.

The analyses revealed the presence of an abnormally large amount of magnesia. A correlation of the chemical composition of these soils with the crop returns obtained therefrom indicated that when the ratio of lime to magnesia soluble in 1 per cent citric solution exceeded 1:3, poor yields of most of the common crops were obtained. These soils in general are poorer in phosphoric acid and potash than the best soils of the territory, but lack of available plant nutrients is not considered to be the primary cause of the low returns.

Peat deposits and their evidence of climatic changes, A. P. DACHNOWSKI (*Bot. Gaz.*, 72 (1921), No. 2, pp. 57-89, figs. 12).—In a contribution from the U. S. Department of Agriculture, data on the structural development of water-laid peat deposits, with particular reference to the influence of glacial geology and climate, are presented.

The chief feature of the group of water-laid peat deposits is said to be the presence of aquatic types of peat material as the initial layer. These deposits are subdivided into (1) basin deposits with standing water level, (2) deposits in depressions with fluctuating water level, and (3) marine deposits such as tidal marsh and mangrove swamps.

As regards evidence of climatic changes, one form is represented in the scattering and mixing of leaves, pollen, and seeds blown into a peat deposit or washed in from adjacent land vegetation. A second kind of evidence found in these deposits consists of dark colored, partly macerated, and fibrous layers of material alternating with predominantly finely fibrous, coarsely fibrous, or woody plant remains, signifying alternating wet and dry environmental conditions. A third form of evidence consists in the seams of clay found between layers of peat material, often with an admixture of organic matter, but rarely laminated in a manner similar to the seasonally laminated glacial clays. The fourth form of evidence is that of the marked structural differences found in certain peat deposits over a wide extent of country, in which a series of moraine systems is the time factor of distinction.

In order to study present climatic changes and plant migration since the culmination of the last stage of glaciation, a comparison of the general stratigraphic features in water-laid peat deposits is made. No very definite conclusions are drawn.

Humus investigations (*Iowa Sta. Rpt. 1920*, pp. 59, 60).—Studies of the effect of hydrogen-ion concentration, hydroxid-ion concentration, and salt concentration on mold growth have shown that with the seven molds used wide variations of tolerance occur. The growth of one mold is inhibited by a concentration of pH 2.0, while another is not kept from growing until a concentration of pH 0.6 is reached. On the alkaline side of the neutral point, pH 8.2 is sufficient to inhibit growth in one case, while it requires a value of 10.3 to stop the growth of another. In general, if the tolerance for hydrogen ions is small, the same is true for hydroxid ions. Of the salts studied, magnesium sulphate was least toxic of the salts that dissolved, all the molds growing in a solution containing 3 gm. molecules per liter and one growing in a saturated solution. Potassium carbonate was most toxic, a concentration of $\frac{1}{8}$ gm. molecule per liter inhibiting growth in all cases, while with several molds $\frac{1}{16}$ gm. molecule per liter kept growth from occurring.

The use of various culture media in characterizing Actinomycetes, H. J. CONN (*New York State Sta. Tech. Bul. 83* (1921), pp. 3-26).—The results of a study of about 75 different types of soil Actinomycetes are presented. This study was made to determine the best media for use in studying them, and to learn the extent of variation in chromogenesis possible with the same culture under different conditions.

It was found that for vigorous and characteristic growth of these organisms a medium containing phosphate, glycerin, and sodium asparaginate is ordinarily sufficient. Media of other composition are often necessary, however, to bring out the most characteristic appearance of any species.

The formula which proved most satisfactory in this work as a medium for routine use in the study of this group of organisms was agar 15 gm., glycerin 10 cc., dibasic potassium phosphate 1 gm., sodium asparaginate 1 gm., and water 1,000 cc. This was the simplest formula giving fairly characteristic and vigorous growth with the majority of the cultures tested. Although not always giving the most characteristic growth obtainable, it is recommended chiefly on account of its simplicity, as it is considered advisable to use the fewest possible ingredients in the case of organisms so easily influenced by minute variations in the medium. It is stated that other media should also be used to separate cultures not distinguishable by their growth on this medium.

Extreme variation in chromogenesis was found to be possible with some of the cultures studied, according to the composition of the medium, and some cultures even vary greatly when studied at different times on the same medium.

It is concluded that "in searching for chromogenesis in this group, it can not be said without investigation that any medium is of no value, nor can it be said that any culture is nonchromogenic until an extremely large number of different media have been used."

Preliminary studies in plant physiology regarding chemical analysis of fertilizers, E. A. MITSCHERLICH, R. HOFFMANN, and H. PAULIG (*Landw. Jahrb.*, 49 (1916), No. 3-4, pp. 335-416, pls. 2, fig. 1).—Studies looking to the determination of physiological values in fertilizers as here made, by methods outlined, involved the mathematical expression of what has been termed a law of physiological relations. The work deals also with the formulation of different fertilizers containing like plant nutrients; the influence of manuring upon the determination of value in fertilizers; injurious effects from mixed fertilizers; and the support given the law by study of the assimilation by plants of different nutrients.

Mitscherlich's law of physiological relation in plant fertilizers, B. BAULE (*Landw. Jahrb.*, 51 (1917), pp. 363-385, figs. 8).—Results obtained with fertilizers as indicated are said to have given a basis for a new formulation of the law of Mitscherlich, as noted above.

An experiment in top-dressing a run-out meadow, E. H. JENKINS (*Connecticut State Sta. Bul.* 231 (1921), p. 351).—The results of six years of an experiment in top-dressing a worn-out meadow are tabulated.

Experiment in maintaining fertility in the garden (*New Hampshire Sta. Bul.* 198 (1921), p. 20).—The results of an experiment begun in 1918 on $\frac{1}{2}$ -acre garden plats receiving manure, green manure, and commercial fertilizers in different combinations showed that for two years there was a remarkable response to manuring by kidney beans and sweet corn, but that the response to chemical fertilizers without the use of manures on a green crop was very small. In the third year potatoes showed an increased yield from the use of chemicals, and additional manure on plats receiving manure alone, manure plus chemical fertilizers, and green manure plus chemical fertilizers did not increase the yield. The effects of liming were quite apparent on sweet corn the second year.

The work of the Marsh Culture Commission, B. TACKE (*Landw. Jahrb.*, 54 (1920), *Ergänzungs.* 1, pp. [3]+346, figs. 12).—This is an extensive and detailed report of the activities of a commission appointed to study and promote the reclamation and cultivation of the swamp and marsh soils of Germany, particularly those marshes along the North Sea.

A brief statement as to the organization and purpose of the commission is followed by analyses of some 85 samples of representative marsh and swamp soils, to indicate their nature and the results of a large number of cropping, fertilizer, and drainage experiments to establish profitable practices for different conditions.

A series of fertilizer experiments on cultivated swamp soils rich in lime showed that both burnt lime and marl increased the yield of both root and grain crops. Nitrogen was the most active of the plant nutrients, followed in order by phosphoric acid and potash. No certain relations were established between the action of individual plant nutrients and the natural content of the soil in these materials. The best results were usually obtained by medium applications of nitrogen and phosphoric acid, while only relatively small applications of potash in the form of concentrated salts gave satisfactory results. Legumes were apparently specially benefited by potash fertilization.

Both pot and field experiments showed that the yield of beets was depressed by potash and phosphoric acid fertilization. Artificial fertilizers gave on the whole better results than animal manures. Fertilizer experiments on garden soils showed that in the majority of cases the use of artificial fertilizers increased crops in spite of the high cultural condition of the soil. The addition of artificial fertilizers to natural manures seemed to be specially effective.

Fertilizer experiments on meadow soils showed that grass crops were increased by liming and artificial fertilization in spite of the relatively large supply of plant nutrients in the soil. No difference was found between Thomas meal and superphosphate as sources of phosphoric acid. Potash was especially active on heavy soils. It was found that proper soil preparation was a necessary preliminary to satisfactory fertilizer action.

Drainage experiments showed that about the same results may be expected from pole drains as from tile drains in marsh soils, although the action of the former is slower in rainy weather. A number of field fertilization experiments showed that while crops were large, phosphoric acid and potash fertilization had little or no effect. Nitrogen fertilization on the other hand had a small but important influence. In this connection it is noted that highly nitrogenous peat litter gave better results than stable manure for such crops as beets and cabbage.

In experiments on hay meadow soils it was found that lime, potash, and composted sludge had practically no influence. The influence of phosphoric acid fertilization depended upon the phosphoric acid content of the soil. The results with artificial nitrogenous fertilizers were doubtful. Liquid manure proved to be quite effective on marsh meadows.

The action of sewage fertilizer in comparison with stable manure, O. LEMMERMANN, K. ECKL, and H. KAIM (*Mitt. Deut. Landw. Gesell.*, 36 (1921), No. 28, pp. 434-438).—Experiments to determine the fertilizing value of so-called humus sewage fertilizer as compared with that of stable manure are reported.

The sewage fertilizer was a mixture of 2 parts of municipal fecal sewage with 1 part of so-called humus carbon obtained from brown coal works. It was brown in color, of a crumbly texture, and had an acid reaction. On a light loamy sand soil it always gave poorer results than stable manure as regards both the total yield and starch content of potatoes. The addition of lime did not improve the action of either fertilizer. A comparison of the action of the nitrogen of ammonium sulphate with that of stable manure and sewage fertilizer showed that 30 kg. (about 66 lbs.) of nitrogen in the form of ammonium sulphate had

about the same effect on potatoes as 68.2 kg. of nitrogen in the form of stable manure and as 135.4 kg. of nitrogen in the form of sewage fertilizer.

Bat guano deposits of Rhodesia, E. V. FLACK (*So. African Jour. Sci.*, 17 (1921), No. 2, pp. 158-170).—A brief study of bat guano deposits occurring in caves in certain parts of Rhodesia is reported, including a number of analyses of both nitrogenous and phosphatic guanos.

The results of a field trial with a nitrogenous bat guano on red diorite soil for maize indicated a marked increase in yield. It is concluded that the bat guano in many of the caves of Rhodesia is of considerable value. It is, however, rated as a poorly balanced manure, although when mixed in an approved formula with proper ingredients and sold at a price which is relatively cheaper than imported or other fertilizers, it should be in great demand. It is considered very doubtful if the bulk of the product could be profitably treated with sulphuric acid for converting the ammonium carbonate into nonvolatile ammonium sulphate, and for setting free the phosphoric acid.

A study of certain green manure crops in making rock phosphate available in soils, R. L. BANCROFT and B. J. FIRKINS (*Iowa Acad. Sci. Proc.*, 25 (1918), pp. 477, 478).—Experiments conducted at the Iowa Experiment Station to determine the influence of green manuring on the availability of the phosphoric acid of rock phosphate in Miami silt loam soil are reported.

Buckwheat, Japanese millet, German millet, bearded and beardless barley, rape, oats, wheat, soy beans, cane, alfalfa, alsike and red clover, cowpeas, and timothy were planted and allowed to grow for three months on soil treated with Tennessee brown rock phosphate at the rate of 1,200 lbs. per acre, and then turned under. The soil was planted to Japanese millet, and 550 determinations of available and total phosphoric acid in the soil were made.

It was found that the greatest yield of millet was produced from soils on which alfalfa, bearded barley, wheat, and cowpeas had been turned under as green manures. These higher yields accompanied a lower percentage of residual phosphorus in the soil and a consequent lower availability of this residual supply. These results are taken to indicate the possibility of manufacturing soluble or available phosphorus in the soil by the aid of certain green-manure crops.

The alkaline reaction produced by acids in soils in relation to plant nutrition.—III, **Solubility of phosphates in soil**, G. MASONI (*Staz. Sper. Agr. Ital.*, 53 (1920), No. 4-6, pp. 121-137).—Continuing work previously noted (E. S. R., 37, p. 18), experiments are reported on the action of N/10 solutions of hydrochloric, nitric, sulphuric, formic, acetic, oxalic, succinic, malic, tartaric and citric acids on the phosphoric acid in mixtures of calcium carbonate with phosphates of calcium, iron, and aluminum, in common calcareous soil, and in a mixture of calcium carbonate, common soil, and superphosphate.

It was found that phosphoric acid was thrown into solution in a calcareous medium after treatment with dilute acids in the presence of lime with the formation of an excess of OH ions. This action depended more on the nature than on the strength of the acids. Citric, malic, and oxalic acids threw more phosphoric acid into solution from calcium phosphate than the stronger mineral acids. In calcareous soil, oxalic acid threw relatively more phosphoric acid permanently into solution than either malic or citric acids in spite of the alkaline reaction of the medium.

In some cases pure water dissolved more phosphoric acid than the acids. This is explained on the basis that water acts exclusively as a solvent, while the acids, by producing an excess of OH ions, cause some of the phosphoric acid already dissolved to pass into insoluble forms. In the experiments with superphosphate the action of water as a better solvent for phosphoric acid than nitric

acid was confirmed. In general it was found that in spite of an excess of hydroxyl ions produced by acid treatment, an appreciable amount of phosphoric acid remained in solution.

It is concluded that these results have an intimate bearing on the nutrition of plants in calcareous soils in that plant roots emit substances, in amounts varying with the plant species, which are capable of throwing sufficient soil phosphoric acid into solution to permit normal plant nutrition in spite of the production of an excess of OH ions.

It is also concluded that as this capacity varies with different plants, so also lime chlorosis is more evident in some plants than in others. Chlorosis is attributed not only to an insufficient absorption of iron, but also to an insufficient absorption of other nutritive elements, particularly phosphoric acid.

The comparative value of different forms of lime, A. G. McCALL (*Maryland Sta. Bul. 242* (1921), pp. 157-166, fig. 1).—Attention is drawn to the general need for lime by Maryland soils, and a summary of the results of several experiments conducted by the station on three different fields, to compare the value of different forms of lime available in Maryland, is presented.

At the College Park field in Prince Georges County burnt lime and burnt oyster shell were compared with shell marl and pulverized raw shell on wheat, corn, and hay on well drained sandy clay loam soil. The shell marl gave the highest yield of wheat and hay, while the pulverized shell produced almost as much wheat and hay and an increased yield of corn.

At the Branchville field in Prince Georges County pulverized raw limestone and oyster shell were compared with the burnt forms for wheat, corn, and crimson clover on heavy silt loam soil. The raw shell gave the largest returns and the burnt shell the smallest. Burnt lime gave slightly less returns than the raw limestone.

At the Ridgely field in Caroline County pulverized raw limestone produced a larger yield of alfalfa hay than pulverized raw oyster shell, burnt oyster shell, or hydrated lime.

The use of gypsum on Iowa soils (*Iowa Sta. Rpt. 1920*, p. 19).—Field studies on the value of gypsum on Iowa soils in increasing the growth of such crops as oats, red clover, and alfalfa have so far shown that it has no influence upon soil acidity and does not serve to replace lime. It shows, however, some effect in making potassium available and in increasing other available plant nutrients.

The fertilizing action of carbon dioxid, A. GEHRING (*Fühling's Landw. Ztg.*, 70 (1921), Nos. 7-8, pp. 137-153; 9-10, pp. 181-197, figs. 2).—The author brings together the results of a number of studies on the production of carbon dioxid in soils by organic fertilizers, such as guanol, and its influence upon crop growth.

It is first shown that guanol exhibits a degree of decomposition of its organic constituents corresponding to that of the most mature peat. The peat used in the manufacture of guanol is not only a fertilizer carrier but exercises an important fertilizing action. It was found in laboratory experiments that both guanol and stable manure in normal applications increase the carbon dioxid production in the soil. When plants were grown under glass on soil so treated they showed a more intense green color than untreated plants, and were more resistant to external injurious influences.

It is concluded that carbon dioxid fertilization in the form of humus additions to soil is a practical possibility of considerable importance, and that guanol, on account of its content of decomposed peat in addition to its mineral nutrient content, is an actual fertilizer of this nature. It was also found

that carbon dioxid fertilization of grain crops with guanol increased the ratio of grain to straw. Further studies showed that liming caused an unmistakable action of carbon dioxid, both in soils which are unfertilized and in soils which have been fertilized with organic matter.

Effects of borax on the growth of potatoes, corn, and beans, E. H. JENKINS (*Connecticut State Sta. Bul.* 231 (1921), pp. 352, 353).—These results have been previously noted from another source (*E. S. R.*, 46, p. 123).

Analyses of commercial fertilizers, H. E. CURTIS, H. R. ALLEN, and R. H. RIDGELL (*Kentucky Sta. Bul.* 230 (1920), pp. 193-320).—This bulletin contains the results of actual and guaranteed analyses and relative valuations of 1,384 samples of fertilizers and fertilizer materials collected for inspection in Kentucky during the year 1920.

AGRICULTURAL BOTANY.

College botany: Structure, physiology, and economics of plants, M. T. COOK (*Philadelphia and London: J. B. Lippincott Co.*, 1920, pp. X+392, pl. 1, figs. 225).—This book, the outgrowth of the author's class work, is an effort to meet the need for an introductory course presenting as many phases of the subject as possible so as to give a broad and general view, and at the same time to meet the demand for applied botany by combining the principles of pure with those of applied botany.

Plants in medicine: Rye and ergot, A. GARRIGUES (*Les Plantes en Médecine: Le Seigle and l'Ergot. Paris: Libr. Octave Doin*, 1921, pp. 254, figs. 22).—This book contains a systematic account of rye (*Secale cereale*), discussed from the standpoint of botany, chemistry, and medicine; of rye ergot (*Claviceps purpurea*) from the standpoint of botany, chemistry, physiology, and therapeutics; and of ergots on other cereals.

Field key to the genera of the gill mushrooms, L. C. C. KRIEGER (*Baltimore: Norman, Remington Co.*, 1920, pp. [8], pl. 1, figs. 6).—A systematic chart showing the logical positions of known gill mushrooms and indicating the positions of logical unknowns is accompanied by descriptive terms, instructions for judging coloration, and an index to the genera represented in the scheme.

The elements of vegetable histology, C. W. BALLARD (*New York: John Wiley & Sons, Inc.; London: Chapman & Hall, Ltd.*, 1921, pp. XIV+246, figs. 75).—This little volume is intended for beginners, though references indicate material intended to be of service to those intending to specialize in vegetable histology, pharmacognosy, and microanalysis of foods.

Morphogenesis of stomata, L. REHFOUS (*Bul. Soc. Bot. Genève*, 2. ser., 12 (1920), No. 1-5, pp. 93-109, figs. 26).—A continuation of work previously noted (*E. S. R.*, 38, p. 821; 41, p. 429) is detailed as applied to the influence of various factors on the structure of stomata of coleoptile and plumule in *Zea mays*.

The ancestral and developmental characters of the coleoptile are strongly marked. The stomata react strongly under the influence of various factors. Differences are said to exist between the stomata in the coleoptile and those in the leaf. The stomata of the coleoptile and those of the plumule are of like origin. It is concluded that different types of stomata are probably derived from a common origin, having been modified during the course of development by different factors. Change of function of the coleoptile gives rise therein to stomata of the plumule type.

The action of extreme conditions on the structure of the stomata in *Zea mays*, L. REHFOUS (*Bul. Soc. Bot. Genève*, 2. ser., 12 (1920), No. 1-5, pp. 110-121, figs. 10).—In a continuation of the studies noted above, it was found that

the change of function in the coleoptile consequent upon the suppression of the plumule gave rise to a series of stomata of the plumule type. However, only secondary characters were acquired in this way. The change of type was due to the growth behavior of neighboring cells.

The plant protects itself against desiccation by the reduction of the number of cells, as well as by changes in the structure of the stomata. High temperatures eventuated in the production of fatty masses supposedly protective against desiccation. All the tissues, particularly that of the coleoptiles, reacted to such factors as dryness of the air, concentration of nutritive solutions, and elevation of temperature.

The growth of *Zea mays* plantlets is inversely proportional to the concentration of the nutritive solutions and to the dryness of the air. When the growth of plants is decreased or arrested their stomata present characters primitive in form.

Vitality of seeds, A. G. EDQUIST (*Roy. Soc. So. Aust. Trans. and Proc.*, 43 (1919), pp. 5-10).—This is a report of an investigation intended to determine whether dry grain (wheat) could be stored safely for long periods in an atmosphere rich in carbon dioxid or nitrogen. It is concluded that vermin may be destroyed in properly inclosed wheat stacks by the use of carbon dioxid (generated by pouring dilute hydrochloric acid on marble or limestone chips) or of nitrogen gas without damage to the germinating qualities of the grain, which may thus be safely stored from harvest until seeding time.

A study of the metabolism of roots, W. J. ROBBINS and W. E. MANEVAL (*Missouri Sta. Bul.* 189 (1921), pp. 29, 30, fig. 1).—In continuation of experiments previously reported (*E. S. R.*, 45, p. 221), the authors studied the growth of isolated root tips in sterile media. It has been found possible to grow isolated corn roots in mineral nutrient solutions containing glucose, mineral salts, and autolyzed yeast for more than 12 weeks. Most of the experiments have been carried on with root tips of corn, but it has been found possible to also grow isolated root tips of peas, cotton, wheat, flax, alfalfa, mustard, radish, and other plants.

Liberation of organic matter by roots of growing plants, T. L. LYON and J. K. WILSON (*New York Cornell Sta. Mem.* 40 (1921), pp. 7-44, figs. 9).—The results are given of investigations carried on to ascertain whether organic matter is liberated by the roots of growing plants. A closely related question, the possible liberation of reducing or oxidizing substances by the roots of growing plants, was also studied.

Maize, oats, peas, and vetch were grown with their roots in flasks of 8 or 12 liters capacity, containing a nutrient solution, the entire contents of the flasks being sterile. At various stages in the growth the plants were removed and analyzed, as well as the nutrient solution and the deposit found at the bottom of the flask. It was found that the nutrient solution in which the plants were grown contained nitrogen only in the form of nitrate when the plants were set in the flasks, but after the plants had grown for several weeks organic nitrogen was always present. The deposit at the bottom of each flask was found to contain a small quantity of organic nitrogen, which was probably derived by sloughing off of the root cells, but it is thought questionable whether such a large quantity could all have come from these cells.

A pea plant grown without the addition of combined nitrogen liberated organic nitrogen into the solution in which it grew. Determinations were made of the total organic matter in the solution from some of the organic flasks, and there was apparently much nonnitrogenous organic matter in the solutions.

The presence of reducing substances in the solutions was indicated by various tests. Peroxidases were always present in solutions in which the plants had grown. Tests for other oxidizing substances were not considered sufficiently satisfactory to warrant the conclusion that they were present.

The behavior of some organic substances in plants, XI, XII, G. CIAMICIAN and C. RAVENNA (*Gaz. Chim. Ital.*, 49 (1919), II, No. 3-4, pp. 83-126, pls. 2, figs. 20; 50 (1920), II, No. 1, pp. 13-46, pls. 5, fig. 1).—The first of these two contributions to the series previously noted (E. S. R., 43, p. 632) is in two parts, the first dealing with the action of some organic substances on the development of plants, and the second with auto-oxidation. The first part of the second contribution (No. XII) deals with the action of organic substances on plant development, and the second with the process of auto-oxidation determined by plant enzymes.

The function of alkaloids in plants, G. CIAMICIAN and C. RAVENNA (*Atti R. Accad. Lincei*, 5. ser., *Rend. Cl. Sci. Fis., Mat. e Nat.*, 29 (1920), I, No. 11-12, pp. 416-420).—Facts obtained during the progress of work noted above show that the natural alkaloids have in general an action markedly toxic for the plant. The significance of this and other facts indicated are discussed.

Absorption of copper from the soil by potato plants, F. C. COOK (*Jour. Agr. Research [U. S.]*, 22 (1921), No. 5, pp. 281-287).—In a contribution from the Bureau of Chemistry, U. S. Department of Agriculture, the author gives an account of investigations, the more important results of which have been noted from other sources (E. S. R., 45, p. 733).

The nutritive value of the food reserve in cotyledons, B. M. DUGGAR (*Ann. Missouri Bot. Gard.*, 7 (1920), No. 4, pp. 291-298, pl. 1, fig. 1).—The data here reported are preliminary and intended primarily to give the results of experiments. These experiments demonstrate, in those cases where the cotyledons serve as a food reserve, the striking importance of these seed leaves in comparison with certain organic substances as a source of food for the normal and vigorous establishment of the young plant under cultural conditions, and suggest the possibility that carbohydrate or hydrocarbon food material stored outside the embryo, as in the case of corn, may be of far less significance. They indicate particularly, however, that the depression of growth accompanying the excision of the cotyledons is marked in the case of peas and other plants with fleshy seed leaves, and that the influence of excision extends throughout the growth period of the plants.

Studies in the physiology of the fungi.—XI-XIII (*Ann. Missouri Bot. Gard.*, 7 (1920), No. 4, pp. 249-289, figs. 11; 8 (1921), No. 1, pp. 1-62, figs. 6; 63-96, figs. 14).—These three numbers continue the series previously noted (E. S. R., 42, p. 224).

XI. Bacterial inhibition by metabolic products, W. H. CHAMBERS (pp. 249-289).—Growth and death of *Bacillus coli* in the culture medium used in these experiments does not follow a continuous curve, though dependent upon the H-ion concentration. This is in turn controlled by the composition of the medium, particularly by the amount of fermentable carbohydrate present. No investigation was made of the limiting influence of other factors, as aeration, on the maximum number of the bacteria present in the culture where the H-ion was controlled.

The maximum content in the culture was, with the H-ion controlled, 3,750,000,000 per cc. as opposed to 281,000,000 in the 1 per cent dextrose bouillon when the H-ion was uncontrolled. No metabolic product autotoxic in its nature could be found. Of the metabolic products, acid is the most inhibitory. The ordinary limits lie approximately between 5.1 and 7.6. In an asparagin- CaCO_3 ,

bouillon, pH=9.5 is not fatal. The inhibitory action of the metabolic products of dextrose other than H-ions is evident only near the critical acid concentration.

XII. *Physiological specialization in Rhizoctonia solani*, T. Matsumoto (pp. 1-62).—From the macroscopical and microscopical investigation of the 15 different isolations of *Rhizoctonia* obtained from a wide range of hosts of different geographical origin, it was possible at the outset to identify some conclusively. The number was reduced to six different types for further physiological studies, which are indicated, outlining the characters and behavior of the different types.

As a whole, the mycelial growth is more sensitive to modification in the carbohydrate supply than to changes in the nitrogen supply. The general tendency is to an increase of active acidity proportionately to growth. Inadequate aeration represses mycelial growth and sclerotial formation in all strains. The hyphae of these fungi may enter the host tissue directly through the cuticle, penetration being chiefly a mechanical process. Infection takes place much more easily through the root than through any other part.

XIII. *The effect of hydrogen-ion concentration upon the accumulation and activation of amylase produced by certain fungi*, J. L. Karrer (pp. 63-96).—The activity of amylase produced by fungi grown in Czapek's solution containing starch and having different degrees of acidity and alkalinity was studied for *Fusarium* sp., *Colletotrichum gossypii*, and *Penicillium italicum*. A relation varying with the organism seemed to exist between the H-ion concentration of the medium and the accumulation of extra- and intracellular amylase. The data are detailed for each of the fungi studied.

A comparison of the pectinase produced by different species of *Rhizopus*, L. L. HARTER and J. L. WEIMER (*Jour. Agr. Research* [U. S.], 22 (1921), No. 7, pp. 371-377, figs. 2).—The results are given of a study of 11 species of *Rhizopus*, all of which were found to produce pectinase and to exude some of it into the culture solution. The amount produced varied with the different species when grown under identical conditions. Two species, *R. nigricans* and *R. artocarp*i, both of which are parasitic in the sweet potato, were found to secrete a relatively small amount of pectinase, while on the other hand, *R. chinensis* and *R. microsporus*, two nonparasitic species, while retaining a small amount of enzym in the mycelium secreted a comparatively large quantity in the culture solution.

Notes on the effect of colored light upon plant growth and pigmentation with a suggestion regarding the precipitation of paint pigments under colored light, H. A. GARDNER (*Paint Manfrs. Assoc. U. S. Circ.* 98 (1920), pp. 1-5, figs. 3).—Potted belladonna seedlings subjected to the influence of different pigments for some days showed, as a result of the influence of purple, a bright yellow color and stem weakness; of green, less yellowing and good physical condition; of red, yellow, and orange, no marked effect upon pigmentation or growth; of white, vigorous growth and normal color; of black, the original green color and more rapid growth than in case of any of the others.

A second series of tests provided with means for admitting air to the plants in containers painted inside in red, yellow, and purple blue, respectively, and covered with glass of corresponding colors, gave results much the same as in the tests noted above, except that etiolation was more rapid in case of the purple blue.

FIELD CROPS.

[Report of field crops work in Iowa, 1920] (*Iowa Sta. Rpt. 1920, pp. 11-14*).—The continuation of previous work (E. S. R., 44, p. 431) is reported.

Additional notes are given on the annual white sweet clover developed by the station, Iowar oats, and Iodent corn. Iogren, a mid-season oat and a pure line pedigreed selection first isolated from the Green Russian in 1911, has averaged 64.9 bu. per acre since 1916, as compared with 57.2 bu. from Green Russian. This oat is considered superior both to the commercial varieties grown in the State and to the pedigreed varieties distributed previously.

As an average for five years, oats drilled in rows 6 to 8 in. apart have given a yield of approximately 3 bu. more than in rows 4 in. apart. Extensive tests, comparing different rates of seeding different varieties of oats, show that more seed should be used per acre in planting Iowar and Iogren oats than in planting smaller grain varieties such as Iowa 103 and Kherson.

Tests to determine the effect of soy beans planted with corn for hogging down or for silage indicate that the corn yield is decreased from 3 to 8 bu. per acre by the addition of the beans. Under most conditions, however, this loss in corn is probably more than made up by the bean crop. During the past three years the largest yields of soy-bean seed were secured in every case from varieties originating in the station breeding nursery.

[Report of field crops work in Missouri, 1920-21], W. C. ETHERIDGE, C. A. HELM, and L. J. STADLER (*Missouri Sta. Bul. 189 (1921), pp. 38-44, figs. 2*).—Experiments including varietal, cultural, and fertilizer trials and breeding work with various field crops are reported, in continuation of previous work (E. S. R., 45, p. 224).

Plowing and double disking wheat and oat stubble in preparation for soy beans greatly increased the yield of hay over double disking alone. The hay from the disked land was about equally soy beans and crab grass, but the plat plowed and disked produced clean soy-bean hay. Comparisons of soy beans and cowpeas showed, as heretofore, the superiority of soy beans for both seed and hay. The yields of seed and hay from the leading varieties of soy beans and cowpeas at the station and substations are tabulated.

The application of lime, acid phosphate, and manure increased the yield of alfalfa by nearly 1.5 tons per acre on average upland soil at Columbia. Alfalfa seeded alone in the spring produced about 0.25 ton per acre more than when seeded with nurse crops of either oats or barley. Sudan grass yielded 16 bu. of seed and 3.5 tons of cured hay per acre at Cuba and 21 bu. of seed and 4.5 tons of hay at Columbia.

Corn, kafir, milo, and feterita averaged 7.7, 27.9, 13.8, and 9.1 bu., respectively, of grain per acre at Cuba, demonstrating that Blackhull kafir, the best variety of grain sorghum tested, is far superior to corn as a grain crop on the thin, dry soils of the Ozark region. Commercial White was outstanding in tests of corn varieties on outlying experimental fields.

The leading varieties of barley were Manchuria and Oderbrucker, but none of the barley varieties equaled the yields of the better oats varieties grown at the same points. The early maturing oats varieties, such as Nebraska 21, Burt, Fulghum, and Kherson yielded highest at Columbia and Warrensburg, while the late maturing varieties, such as American Banner and Swedish Select, excelled at Maryville. The averages of a long series of seasons, however, showed that early maturing varieties are superior in yield to late maturing sorts in every section of the State. The yields of over 50 varieties at Columbia, grouped according to the relative time of maturing, averaged as follows: Early 50.4 bu., medium-early 44, medium-late 39, and late 23.3 bu.

Winter wheat surpassed spring wheat in every section of the State. Hard wheat outyielded soft wheat at Maryville, and about equalled it at Warrensburg and Columbia, but in an average of many seasons soft wheat has been distinctly superior to hard wheat in every section of the State except the northwest corner, where the yields are nearly equal.

[**Report of field crops work in Montana**] (*Montana Sta. Rpt. 1920, pp. 19, 20, 21, 31, 32, 36, 38, 40, 41, 42, 43, 44*).—The progress of experiments with field crops at the station and substations is described as heretofore (E. S. R., 44, p. 331).

The leading varieties in tests conducted under irrigation at the station by P. V. Cardon were Kharkof winter wheat, Marquis spring wheat, Abundance oats, Coast and Trebi barley, Carlton peas, Choice Navy beans, New Japanese buckwheat, Oxheart and Chatenay carrots, Eureka silage corn, and Half Sugar Rose, Giant Feeding Sugar, and Banes fodder beets.

Mammoth Russian sunflowers seeded May 14 averaged 29.6 tons of silage, while a July 1 seeding made only 15.6 tons, with intermediate seedings between these in yield. The results of seeding tests favored 36-inch rows drilled at the rate of 5 to 6 lbs. of seed per acre. Sunflowers were found to be largely self-sterile and to require special precautions for the production of pure seed. The seed of bagged heads, although perfect in size and appearance, were from 90 to 100 per cent infertile. Bagging also materially changed the flowering habits of the plant, all of the flowers on a bagged head opening at the same time instead of in the usual manner.

Annual white sweet clover from the U. S. Department of Agriculture seeded May 15 grew to a height of 64 in., and when harvested October 9 averaged 5.45 tons of air-dry hay. Although about 75 per cent of the flowers set seed, none matured on account of frost.

Frosted wheat (E. S. R., 43, p. 501) of Marquis and Kubanka varieties showed a surprisingly high value in milling and baking studies by W. O. Whitcomb. In a few cases small-kerneled wheat showing a high laboratory germination failed to make a good stand under the most favorable field conditions.

Neither fertilizing seed plats of potatoes with nitrate of soda, planting seed thickly in the plats, nor thinning the hills to single stems caused a decided variation in the productivity of the seed in tests conducted by C. C. Starring. Poor results followed the use of small potatoes for seed. H. Thorner found that land enriched by plowing under peas and clover yielded from 100 to 400 per cent more potatoes than land clean cultivated for years. A preliminary test of the loss in yield through missing hills showed that hills adjoining a vacancy made up more than 55 per cent of the loss. On rich soils only 39 per cent of the loss was compensated, while as much as 70 per cent was made up on poor soils.

Work at the Huntley Substation was conducted by D. Hansen in cooperation with the U. S. Department of Agriculture (E. S. R., 44, p. 732). The average acre yields in 1920 on fallow, on disked corn land, and from all experiments, respectively, are as follows: Winter wheat 30.7, 34.4, and 28.7 bu.; spring wheat 11.6, 13.6, and 12.4 bu.; oats 34.9, 27.8, and 30.2 bu.; barley 4.2, 15, and 15.1 bu.; and flax 6.3, 7.4, and 5.3 bu. Barley made its maximum yield, 34 bu., on disked flax stubble.

As noted by A. Osenbrug, the stands of winter wheat at the Judith Basin Substation were greatly impaired by drifting soil during the winter and early spring of 1920. Winter wheat seeded with the furrow drill averaged 5.8 bu. more per acre than that seeded with the ordinary drill, due almost entirely to the smaller amount of winterkilling. Furrow drilling winter wheat is indi-

cated as a promising means of retarding soil drifting and preventing winter-killing. In a season at the North Montana Substation, which was very unfavorable for winter grains, G. W. Morgan reported that all winter wheat except that seeded with the furrow drill was winterkilled, regardless of variety, rate, date, or method of seeding.

[Report of field crops work in New Hampshire, 1919-1920] (*New Hampshire Sta. Bul.* 198 (1921), pp. 13-15, 16).—Varieties outstanding in comparative trials and their acre yields were as follows: Eureka silage corn 17.3 tons, Ohio 9920 winter wheat 39.5 bu., Swedish Select oats 52.4 bu., Imperial Green Globe turnip 26.4 tons, Magnum Bonum swede 27.6 tons, and Long Island Improved rutabaga 24.45 tons.

Beneficial results followed the inoculation of soils growing soy beans for the first time. Late dent and late flint varieties of corn from the U. S. Department of Agriculture were planted for silage on April 27 and May 7, 17, and 27. No differences were noted in the frequency of tasseling, or the stage of maturity on October 5 of the three earlier plantings, to indicate any particular advantage in early planting. The ears of the fourth planting, however, were softer and less mature than the others.

[Report of field crops work in Texas, 1920] (*Texas Sta. Rpt.* 1920, pp. 23-31, 39-41, 48, 54, 55, 57, 58, 59-61, 63-65, figs. 8).—Corn planted at the station at rates from 2,420 to 9,680 stalks per acre yielded from 21 to 71 bu., with intermediate rates ranging in yield between the two extremes. Planting cowpeas between the rows at corn planting time reduced the corn yield 16.5 bu., or more than 50 per cent, but cowpeas planted when corn was beginning to tassel did not diminish the corn yield. The best yielding strain of Bluegrain corn in ear-to-row tests at Nacogdoches yielded eight times as much grain as the poorest selection.

Experiments at Denton indicated the necessity of deep early plowing followed by adequate clean tillage during the summer, preparatory to planting winter wheat. Early deep preparation of the seed bed for wheat followed by clean tillage produced the most grain at Chillicothe, and late, indifferent listing produced the least. Kanred proved to be the best hard red winter wheat at Chillicothe, Denton, and Temple, and results secured at the two latter stations indicate that the hard wheat belt can be extended southward and eastward.

Appler, T. S. No. 1118, and Ferguson No. 71 oats gave excellent yields at Denton, several pedigreed strains of Appler producing over 100 bu. per acre. Rust resistance has been found to be lacking in many of the so-called resistant varieties.

Work with grain sorghums has been noted (*E. S. R.*, 45, pp. 233, 535).

Rice responded readily to ammonium sulphate, with cottonseed meal second as a source of nitrogen in experiments at Beaumont. The application of fertilizer to weed-infested fields, or early in the season, resulted in increased weediness and decreased yields, but where the fields were carefully cleaned, seeded later, and fertilized when the rice was well established, decided increases in yield were secured.

Guar was entirely unaffected by root rot at Temple, indicating a legume crop valuable for soil improvement and not serving as a host for the disease.

Sweet clover proved a success at practically every substation, being specially suited to the North Texas wheat belt and to the needs of the exclusive small grain farmer. The crop has been successfully planted in wheat or oats in January and become well established at the time of cutting the small grain. The biennial type lives over into the next summer, providing at least two hay crops or almost a year of good pasture and beneficial effects on the

yield of the succeeding crop. The use of treated or scarified sweet clover seed has been found safest.

Peruvian and common American alfalfa seem to be the best sorts for the Trans-Pecos region, while Canadian Variegated, Grimm, Turkestan, and Chilean varieties are decidedly unadapted. Heavier applications of irrigation water are suggested for the successful production of alfalfa in the region. Agronomic studies at Spur indicated that rather thin seeding of alfalfa in drills is advisable under the dry-land conditions, and that superior strains of alfalfa can be established by isolating and increasing high-yielding individual plants.

Extensive tests at the station and substations of cotton varieties from all cotton-producing sections of the United States and from foreign countries showed that Texas cottons, such as Mebane, Lone Star, Truitt, Bennett, Rowden, Belton, Acala, Kasch, and varieties of similar type are better suited for Texas than any of the varieties commonly grown east of the Mississippi River. In endeavors to obtain pure and uniform strains of cotton for breeding stock, five years of extensive inbreeding have not accomplished absolute purity. High and low oil strains (E. S. R., 45, p. 229) have been developed by ordinary methods of selection and inbreeding, but the high oil strains gave a low turnout of lint, which the increase in value due to the high oil content was not sufficient to offset in the strains thus far established. High oil cottons were found to have large seeds. Cotton planted at Beeville on soil which had not grown the crop for two years exhibited practically no root rot, while that planted on land following cotton showed severe losses, demonstrating the value of crop rotation in combating the disease. The results of a rate-of-planting experiment at Nacogdoches indicate that the best yields were secured from three plants per hill, that check-row planting may be as productive as other methods, and that a relatively high number of plants per acre is advisable instead of thin planting on land of good fertility. In the cotton cultivation experiments at Chillicothe, where other conditions were equal, weeds and grass were found to be the chief causes of reduced yields, rather than the presence or absence of a soil mulch.

Ash content of the awn, rachis, palea, and kernel of barley during growth and maturation, H. V. HARLAN and M. N. POPE (*Jour. Agr. Research* [U. S.], 22 (1921), No. 8, pp. 433-449, figs. 5).—Supplementing earlier work (E. S. R., 43, p. 826), a number of varieties of barley were studied to determine if usable variations existed in the amount of ash deposited in the rachises and awns, and the nature of the changes occurring after kernel sampling became impossible. Material for the studies was secured from Chico, Calif., and Aberdeen, Idaho, and ash determinations were also made on varieties grown at Arlington, Va.

The awn of barley receives a very large deposit of ash, comprising over 30 per cent of the dry weight in some varieties. Barleys differ in the amount of ash deposited in the awn and probably in the selective function of the absorbing roots. Within a variety the amount of ash in the awn is correlated with the supply of soil water and probably with the amount of water transpired.

Varieties with a low ash content in the rachis do not necessarily have a low ash content in the awns, and the awn itself does not have the same ash content throughout its length. In determinations made on different portions of the awns of three barleys from Chico, Calif., the ash content of the tip was much greater than that of the base.

Varietal differences exist in the amount of ash deposited in the rachis. While the rachises of hooded and awnless varieties are usually high in ash and usually brittle, their tendency to shatter may possibly be overcome by crossing them with barleys of the Coast type, which have little ash in their rachises.

No part of the kernel proper is used as a repository for ash, the ash of the kernel being the ash of the cell sap and of highly active protoplasm. When computed on the basis of wet weight, a measure of the organ when active, almost no variation in the proportion of ash is shown. During most of the period of growth the variation is only 0.3 per cent, the ash content increasing gradually from slightly less than 1 per cent in early growth to slightly more than 1 per cent at maturity.

Some physical and chemical studies of certain clones and sibs of brome grass. L. R. WALDRON (*North Dakota Sta. Bul. 152 (1921), pp. 3-28, pls. 4, figs. 3*).—Promising individual plants of smooth brome grass (*Bromus inermis*), chosen from among several thousand individual brome plants, were divided vegetatively and grown in clonal beds in comparison with timothy. A study on the rate of culm formation in brome grass has been noted (E. S. R., 45, p. 825).

Yields from five cuttings made during three years show that certain clonal beds embracing certain types of plants outyielded other beds very decidedly. Some clones are evidently much better sources of breeding and selection material than others, provided the desirable characters appear sufficiently pronounced in succeeding generations when obtained through self-sterilized seed.

Chemical studies upon the several brome-grass clones revealed striking variations for the different constituents. Some of the high-yielding clones carried a high percentage of protein, one in particular producing three times as much protein per acre as one of the low-yielding clones. A positive correlation apparently existed between yield and protein content, but such striking and important variations were not exhibited by the other constituents. Decided variations were found in the ash content of the different clones, especially with regard to phosphorus and sodium. One clone carrying 16 per cent of crude protein on a dry-matter basis was also high in all ash elements. The author asserts that hay of this sort would have considerably higher than average feeding value, especially if protein were a constituent of importance.

The clonal brome grass exceeded timothy by 3 per cent in ash content, 2 per cent in crude protein, and 0.5 per cent in true protein and crude fiber content, while timothy exceeded bromes 0.5 per cent in ether extract and 5 per cent in nitrogen-free extract. The clonal brome grasses exceeded 17 commercial brome grasses, grown in different States and Canada, nearly 2 per cent in ash, but the miscellaneous bromes exceeded clonal lots over 1 per cent in ether extract and over 5 per cent in nitrogen-free extract. In a comparison between beds of sibs and clonal beds in brome grass, the beds of sibs generally outyielded the clonal beds the first year of planting, while the yields were about equal in the second year. Measurements of leaf blades from sibs and from clones showed a greater leaf area for the clonal leaves, with a great variability for the leaves of the sibs. The possibility is mentioned of using differences of variability to determine closeness of inbreeding when other conditions are similar.

A study of physical characters and some of their correlations in *Bromus inermis*. L. R. WALDRON (*North Dakota Sta. Bul. 153 (1921), pp. 3-32, figs. 5*).—An analysis was made of the physical characters of two lots of smooth brome grass from different geographic sources and designated Canadian and South Dakota, respectively.

A lesser number of Canadian plants produced fertile culms the first season than did South Dakota, but the Canadian averaged more fertile culms per plant. Culms of South Dakota plants, the first season of growth, were decidedly taller than those of Canadian plants. From a comparison with other grasses, height in brome grass is deemed rather more variable. Curves were fitted to the two distributions of height, Type V being used in both cases.

Height increased in each of three years following seeding, while maximum plant weight was attained the second year (third year from seed). Maximum weight the second year did not appear to be a functional character of the plant, nor conditioned by limited food supply or other external causes. The marked diameter increase of the plant from year to year was very evident. The data indicate a less rapid deterioration of South Dakota plants than of Canadian plants, both considered as groups. Coefficients of correlation between height and weight in the two plant groups were significantly positive in all cases, but not over 50 per cent. The maximum regression was such that a plant deviating half the entire range in weight involved a deviation of less than 10 per cent in height. Coefficients between plant weights were marked between successive years only. Coefficients for Canadian plants were distinctly the larger, indicating that a selection of a heavy Canadian plant would more probably remain heavy for another year than a similarly selected South Dakota plant. Selections for extreme types in weight should evidently be made before the plants advance far in life. The author feels that the less rapid deterioration of the South Dakota plants is probably due to the inclusion of a comparatively larger number of poor plants in the Canadian group.

Plants of *B. inermis* are characterized by certain percentages of sterile culms, plants selected from a population of brome grass during the first year of growth for low and for high percentage of sterile culmage remaining sharply marked off from each other during the following three years. As considerable gradation of values appeared within each group, it is thought that a large random sample from a population would probably exhibit complete gradation between the two extreme types.

The weight of the individual sterilclinous plants was larger in 1917 and 1918 than that of the fertilclinous plants, but less in 1919. Assuming the increased sterilclinous culms to be an absolute addition to the plant may partly account for the greater initial weight of the sterilclinous plants. Increase in sterile culmage would not inhibit the formation of fertile culms. The two groups of plants were sharply defined each year in regard to percentage of sterile culms. The difference in percentage weights is quite significant, the percentage weight for both groups being much lower for 1917, reaching the maximum in 1918, and intermediate in 1919. The character of the season, and possibly the age of the plant, are evidently largely responsible for the comparative percentage of sterile culmage.

In regard to total weight of plant and to weight of sterile culms, the correlation is positive and rather significant when made between two successive years, but greatly diminished though still positive between alternating years. Correlation between percentages of sterile culmage for both sterilclinous culms was positive in all cases, but generally of doubtful significance. The calculation of both gross and spurious correlations between total plant weight and percentage of sterile culmage clearly indicates a negative correlation between the two characters, i. e., the heavier plants carry less sterile culmage. It is suggested that the heavier plants have sufficiently thicker stands of fertile culms to somewhat inhibit the growth of the sterile culms.

Characters connected with the yield of the corn plant, W. C. ETHERIDGE (*Missouri Sta. Research Bul. 46* (1921), pp. 3-17, fig. 1).—The following studies, made by C. B. Hutchison, C. E. Neff, S. B. Nuckols, et al., and concerned with correlations between structure and function in the corn plant, are reported:

I. *A study of the correlation between yield and certain characters of the corn plant* (pp. 3-11).—Ten each of long-slim, long-thick, and short-thick smooth ears; of ears of medium length, thickness, and indentation; and of long-slim,

long-thick, and short-thick rough ears of Boone County White corn were planted in ear-rows. Agronomic data were secured prior to the tasseling stage on 40 normal plants in each of the 70 rows.

No significant differences between the yields of the plants from the various types of seed ears were apparent. "Within the conventional limits of a variety of corn, no variation in the visible structures or characters of a normal, healthy plant is a reliable index of the relative ability of its progeny to yield. The relative yield of the mother plant is the only indication, uncertain as it may be, of the relative yield of the progeny."

II. *A study of the relation of certain ear characters to shelling percentage, shrinkage, and viability* (pp. 12-17).—Six-hundred sixty sound ears of a large rough-eared type of Boone County White were harvested in December, 1909, and stored in a tightly boarded crib until March 1, 1910. Five hundred ears of a more variable strain of the variety, grown on similar soil, but harvested early in October, 1910, were air-dried on racks in a mouse-proof seed room for a period of 12 weeks. The individual ears were described in detail, and comparisons made between the two classes exhibiting extreme variation of the character in question.

Ears extremely characterized by deep kernels, narrow kernels, or starchy kernels had a slightly higher shelling percentage than ears of the opposite extremes, but no other ear characteristics showed a significant relation to the proportion of grain.

Heavy ears, thick ears, deep-kerneled ears, and ears with a large number of rows, i. e., characteristics closely related to the size of the cob, lost considerably more weight than ears of the opposite extremes during a 6-week drying period. Other characteristics of the ear showed no relation to the total loss of moisture. In all types of ears more than 75 per cent of the total shrinkage occurred during the first third of a drying period of 12 weeks. Additional shrinkage was very slow during the remainder of the period, indicating that seed corn, air-dried on racks or other devices for about a month under similar climatic conditions, may safely be stored in a more convenient bulk.

Smooth kernels, shallow kernels, horny kernels, and kernels with small germs showed a higher viability than kernels of the opposite extremes. No characteristic of the ear as a whole showed a relation to viability not traceable to the moisture content of the cob. It is suggested that the previous treatment of the seed possibly influenced the relative viability of the different types.

Test of Perilla, E. H. JENKINS (*Connecticut State Sta. Bul.* 231 (1921), p. 352).—Plantings of *P. frutescens* made May 31 averaged from 44 to 46 in. in height, had commenced to bloom, and were sparsely branched on September 18, but were killed by cold soon after. It is thought that seed could be produced in the region only by starting the plants in the greenhouse and transplanting later to the field.

Investigations with seed potatoes, J. T. ROSA, JR. (*Missouri Sta. Bul.* 189 (1921), p. 45).—Home-grown seed from the fall crop equaled northern seed, while home seed from the spring crop proved of much less value.

Timothy as a cover crop for tobacco land, E. H. JENKINS (*Connecticut State Sta. Bul.* 231 (1921), pp. 354-356).—Tobacco growers concerned with diminishing yields on their fields are urged to test timothy as a cover crop at least three years in succession, seeding early and fairly heavy, as the only visible alternative to temporarily replacing tobacco with other crops. Observations on the amount of organic matter and plant food gathered from a tobacco soil and held for the crop indicate that an even, thick stand of timothy may contain, when plowed under, about 3 tons of vegetable matter, 100 lbs. of nitrogen, 50 lbs. of phosphoric acid, and more than 100 lbs. of potash.

New cigar tobacco varieties, T. HOUSER (*Ohio Sta. Mo. Bul.*, 6 (1921), No. 9-10, pp. 135-138).—Brief descriptions are given of strains of cigar tobacco originating at the Southwestern Test Farm at Germantown, Ohio, with tables summarizing their parentage and comparative yields. The best selections of new strains—Montgomery Seed Leaf, Seed Leaf 548, and Spanish 585—averaged 715, 166, and 478 lbs. per acre, respectively, more than the best selections of Pennsylvania Seed Leaf. The best selections of Tall Zimmer, Spanish 585, Dutch 307, Dutch 609, and Dutch 620 averaged 508, 1,030, 852, 1,000, and 935 lbs., respectively, more than the best selections of Zimmer Spanish during the same periods.

Tobacco in Wisconsin, J. JOHNSON and C. M. SLAGG (*Wisconsin Sta. Bul.* 337 (1921), pp. 36, figs. 21).—A general discussion of tobacco culture in Wisconsin, with special reference to the cigar binder type, treating of tobacco seed and seed beds, management of the field, harvesting, curing in the shed, and preparation of the crop for market.

Genetic behavior of the spelt form in crosses between *Triticum spelta* and *T. sativum*, C. E. LEIGHTY and S. BOSHNAKIAN (*Jour. Agr. Research [U. S.]*, 22 (1921), No. 7, pp. 335-364, pl. 1, figs. 3).—This joint contribution from the Office of Cereal Investigations of the U. S. Department of Agriculture and the College of Agriculture of Cornell University presents an account of the different modes of inheritance in crosses between *T. spelta* and *T. sativum*.

T. spelta and *T. sativum* are differentiated by a number of linked specific characters, present in one species and absent in the other, and, so far as observed, not inherited independently but transmitted as a group. In crosses between a spelt and common wheats the F_1 hybrid shows dominance of the spelt, but this character appears in a somewhat diluted form. In the F_2 all classes of spelt inheritance are obtained.

There was only one factor difference for spelt in most of the material studied, but in two cases two spelt factors were present. Both 3:1 and 15:1 ratios were obtained and were verified after determining the genotypic constitution of the F_2 plants, which gave pure breeding spelts, inconstant spelts, and pure breeding wheats in the ratios of 1:2:1 and 7:8:1, respectively. Of the constant spelts produced in crosses with the latter ratio, approximately half yielded (in the F_3 generation) spelts and wheats in the ratio of 15:1 and the other half in the ratio of 3:1, as expected on the two-factor hypothesis.

When the speltoid form Gatineau, which originated from a cross between *T. durum* and *T. sativum*, was crossed with wheats a 3:1 segregation of spelts and wheats was also given, but the curves showing the classes of spelts produced by this cross differed entirely from those produced by the spelt-wheat crosses segregating in the same ratio.

"Aside from the factor or factors for speling, there is positive evidence showing the presence of intensifying and diluting modifiers which tend to affect the degree of spelt characters without affecting to any extent the ratios of spelts to wheat. Some of the diluting modifiers tend to act as inhibitors." The progeny of all heterozygous spelts of the Ss type do not produce a similar spelt curve, as wide discrepancies exist in the spelt inheritance of the progeny of these forms. These variations within the spelt classes have been found to be hereditary and to be caused by modifiers.

The theoretical possibility of producing synthetic wheats in crosses between certain pure-breeding spelts is shown. Experimental evidence also is presented showing that, in spite of the dominance of the spelt character over the wheat form, the former may be synthetically produced by crossing certain wheats, provided one of the wheats carries a spelt factor together with an inhibitor

and that the other wheat carries neither. If intensifying, inhibiting, and diluting modifiers are introduced in a cross, wide departures may be expected from the 3:1 and 15:1 ratios.

Rate of seeding as affecting yields of wheat, L. E. THATCHER (*Ohio Sta. Mo. Bul.*, 6 (1921), No. 7-8, pp. 111-115, fig. 1).—Wheat seeded at the rate of 8 pk. per acre gave the largest average net yields at the station, 29.28 bu., and in Clermont County, 17.84 bu., while the rate of 7 pk. gave best returns in Meigs County, in Montgomery County, and at the University Farm at Columbus, with 25.19, 21.17, and 38.24 bu., respectively. Based on reports from 246 different points, the average rate for the State is 7.2 pk. per acre. The average acre rates for the northern, central, and southern sections of the State were 7.5, 7.15, and 6.2 pk., with 10-year average acre yields of 16.9, 13.8, and 11.2 bu., respectively. When a good tillering variety and a medium tillering variety were planted at rates from 1 to 10 pk. per acre, spaced from 25 to 250 kernels per 100 in. of row, the number of culms per plant decreased as the rate of seeding increased, with the greatest decrease appearing in the good tillering variety.

Fertilizing the wheat crop, C. E. THORNE (*Ohio Sta. Mo. Bul.*, 6 (1921), No. 7-8, pp. 98-107, figs. 2).—Adjustment of the rotation, early seed bed preparation, choice of the variety, and liberal seeding and fertilizing are discussed as factors conducive to greater economy in wheat production, and some of the results secured in the station experiments are set forth as heretofore (*E. S. R.*, 35, p. 536; 36 p. 38; 37, pp. 238, 831; 39, p. 540; 42, p. 636).

Results of extensive trials with acid phosphate on wheat in various rotations, including clover after wheat, did not exhibit an injurious effect from the moderate use of acid phosphate on limed or unlimed land. The clover apparently furnished sufficient nitrogen to benefit the wheat four years later and also converted the inert potassium in the soil to a form available to wheat. The addition of raw phosphate to acid phosphate in the five-year rotation at Strongsville did not increase the yield of wheat or of the other crops in the rotation over that returned by acid phosphate and limestone, until both nitrogen and potassium were added to the phosphate.

Eradication of loco weed, D. B. SWINGLE and H. WELCH (*Montana Sta. Rpt.* 1920, pp. 25, 26, 34).—Experiments in the eradication of loco weed on hilly grazing land by grubbing gave indications that a plant cut off below the crown will not sprout from the root, that minute seedling plants are easily overlooked when grubbing, and that seeds in the soil will start new plants which must be grubbed later. The work of grubbing was very small the second year compared with the first year.

On reseeded grubbed areas with forage plants, the best results were obtained from the use of yellow sweet clover.

HORTICULTURE.

[**Horticultural investigations at the Iowa Station**] (*Iowa Sta. Rpt.* 1920, pp. 44-48).—In this progress report of activities, in which various results are discussed without presenting data, a study of the value of several apple varieties as stocks showed the particular value of Wealthy, Virginia Crab, and Hibernial on account of hardiness. Wealthy and Haas showed particular promise as stocks for Jonathan, and Virginia Crab for Grimes Golden. Delicious, when top-worked on Virginia Crab, came into bearing earlier and gave a better yield than when grown on its own roots.

Observations in an experimental orchard near Council Bluffs indicated that greater winter injury occurred in trees grown with continuous clean cultivation

than in trees grown in blue-grass or leguminous sod. This fact was particularly noticeable in the case of Ben Davis trees. The average annual production during the period 1911-1920 was greatest on the clover-sod plats, leading the author to conclude that this type of culture, supplemented with fertilizers and manure, will probably prove best for the orchards of the Middle West. It was observed that trees growing in the clover-sod and cultivated plats were more inclined to annual bearing than trees in blue-grass sod.

Horticulture, V. R. GARDNER ET AL. (*Missouri Sta. Bul.* 189 (1921), pp. 44, 45, 46).—Without reporting data, brief notes are given on the progress of various investigational activities during the year ended June 30, 1920.

In analyzing apple spurs of several lengths it was found that starch accumulations during June were greatest in those spurs showing highest fruit bud differentiation. Such spurs were also characterized by a rise in the total nitrogen content of the two-year-old wood. Analyses at frequent intervals of the spurs and bark of York trees, following applications of nitrogen fertilizers early in the bearing year, indicated no increase in nitrogen content as a result of fertilization. On the other hand analyses of the bark and spurs of York trees, fertilized with nitrogenous materials at different periods in the off year, indicated considerable effect of the fertilizer on the nitrogen content, varying with the time of application. Observations on the blossoming of seedling apples in the late-blooming project indicated that many will be of late-blooming habit.

[**Report of the**] **department of horticulture** (*New Hampshire Sta. Bul.* 198 (1921), pp. 19, 20, 21).—Activities under various projects are noted.

In a test of types of pruning with apple trees planted in 1918 it was observed that much larger trees have resulted from light pruning. John Baer tomato gave the highest yield among 12 varieties and strains tested in the station greenhouse in 1919. In outdoor trials Sunny Proof strain of Earliana yielded more ripe tomatoes than any other variety. Fertilizer trials in 1920 with tomatoes indicated the value of phosphorus as a supplement to barnyard manures.

[**Horticultural activities at the Texas Station**] (*Texas Sta. Rpt.* 1920, pp. 8-10, fig. 1).—In a test of longevity of peach stocks, Indian Cling has to date shown the lowest percentage of mortality. In studying the comparative hardiness of several varieties of grapes on their own roots and on *Vitis champinii* stock, it was found in every instance that plants on their own roots perished first. All the vines now living are on *V. champinii* roots. A new berry produced at the station by hybridizing the dewberry and raspberry is described and, because of its desirable qualities, is being disseminated under the name "A. & M. Berry." A peculiar phenomenon was observed in the course of the development of this berry, almost complete sterility being noted in the first generation, disappearing suddenly in the second.

Research work in Massachusetts, H. F. TOMPSON (*Market Growers Jour.*, 30 (1922), No. 1, p. 7).—Some of the more important projects at the Lexington, Mass., Market Garden Station are outlined, including a manure economy test, selection studies with Martha Washington asparagus, general variety tests, and insect and disease control problems. Remarkable variations were found in the yield of individual asparagus plants in the spring of 1921, some of the most productive plants yielding 40 marketable stalks, an estimated yield of over 5 tons per acre.

Research at Virginia Truck Station, T. C. JOHNSON and H. H. ZIMMERLEY (*Market Growers Jour.*, 30 (1922), No. 1, p. 6).—A statement of the various investigational activities under way. These are divided into three general

groups, (1) soil fertility, (2) insect and fungus control, and (3) seed production and relation of different strains of seed to yield.

Rhode Island Station fertilizer tests, B. L. HARTWELL (*Market Growers Jour.*, 30 (1922), No. 1, pp. 8, 31).—In this address, delivered at the 1921 convention of the Vegetable Growers' Association of America, the author discusses the results of various fertilizer and rotation studies with vegetables. Earlier accounts of these experiments have been noted (E. S. R., 46, p. 233).

In a study of the effect of the first crop upon the second of the same season, it was found from four-year averages that late cabbages planted after spinach, beets, potatoes, and peas yielded, respectively, 10.13, 9.95, 9.62, and 8.71 tons. Tabular data representing the average annual yield during the six-year period 1916-21 are presented, showing the effect of fertilizers and manures on vegetables grown in four different rotations. Greater yields were obtained in a rotation receiving manure in heavy amounts than in rotations including green manure crops but receiving little or no manure. It was also indicated that the moderate application of manure supplemented with chemicals was more effective than heavy applications of manure alone. In determining the amount of dry matter produced above ground by nine different green manure crops broadcasted after the middle of July, it was found, based on three-year averages, that Japanese millet produced the greatest yield, closely followed by pearl millet.

Research and can-crop profits, C. G. WOODBURY (*Market Growers Jour.*, 30 (1922), No. 1, pp. 11, 26, 27, 28).—A paper delivered before the Vegetable Growers' Association of America in 1921, emphasizing the importance of investigation to the canning crop industry and pointing out problems needing further study.

Variety trials of lettuce, J. B. KEIL (*Ohio Sta. Mo. Bul.*, 6 (1921), No. 9-10, pp. 139-148, figs. 4).—Descriptive data are presented for several important varieties of head, loose leaf, and cos lettuces. Selection is deemed a satisfactory method of improvement of lettuce varieties, as demonstrated by the development in the station greenhouses of a tipburn-free strain of May King and a uniform strain of Grand Rapids.

Relation of pressure to effectiveness in spraying tomatoes, D. B. SMITH and H. H. ZIMMERLEY (*Virginia Truck Sta. Bul.* 33-34 (1920-21), pp. 161-190, figs. 10).—A report of investigations conducted in 1919 and 1920 on the comparative value of three different pressures, 75, 140, and 200 lbs., in spraying early tomatoes for the control of the fruit worm (*Chloridea obsoleta* Hbn.), leaf mold (*Cladosporium fulvum*), and leaf spot (*Septoria lycopersici*). Two different sprays, Bordeaux mixture (4:6:50) with 2 lbs. arsenate of lead and a copper soap solution (0.5 lb. copper sulphate, 3 lbs. resin fish oil soap, and water to make 50 gals.) applied at 140 lbs. pressure, were tested. Five varieties, John Baer, June Pink, Bonny Best, Earliest of All, and Earliana, were included in the 1919 test, and with the exception of Earliest of All were again used in 1920. Seven applications were made in 1919 and five in 1920.

The plants sprayed at 200 lbs. pressure gave the largest yields of marketable fruits both years, producing in 1919, 4,603 more pounds and in 1920, 6,202 more pounds per acre than the unsprayed plants. Plants sprayed at 140 lbs. pressure outyielded the unsprayed by 3,323 lbs. in 1919, and by 5,020 lbs. in 1920. Plants sprayed at 75 lbs. pressure gave an increased yield over the unsprayed of 2,582 lbs. in 1919 and 3,884 lbs. in 1920. The increased yield of the sprayed as compared with the unsprayed plats was due to the increase in both size and number of fruits.

Although less insect injury was recorded in the sprayed plats than in the unsprayed, only slight variation was observed in 1919 in the comparative value

of the three pressures in this respect, the differences in marketable fruits being largely due to the control of fungus diseases. Greater variation was noted in 1920. The test of the copper soap solution indicated that this material was not so satisfactory as Bordeaux mixture, and under the conditions obtaining in 1919 apparently checked the vine growth and reduced the total yield below that of unsprayed plats.

Localization of the factors determining fruit-bud formation, H. D. HOOKER, JR., and F. C. BRADFORD (*Missouri Sta. Research Bul.* 47 (1921), pp. 3-19).—This is a report of a series of studies, largely of a biometrical nature, the object of which was to establish the location in the apple tree of the factors influencing fruit-bud differentiation.

Following the findings of Roberts (E. S. R., 44, p. 41), namely, that in the Wealthy and certain other varieties certain spur lengths are associated with maximum fruit-bud differentiation, the authors measured a large number of spurs on four apple varieties in the university orchard, excluding all spurs which had not blossomed once or which contained one season's growth in excess of 10 cm. length. The length at which spurs showed greatest fruit-bud development differed sharply between varieties; however, a strong tendency was noted for a continuing increase in percentage of fruit-bud formation corresponding with increase in length. This fact is held to indicate a considerable autonomy in the individual spur.

That the tree as a whole has an influence on spur performance was indicated in a study of fruit spurs from six biennially fruiting Gano trees. Marked differences were noted between the distribution of spur performance in the off and bearing years. All examinations of spurs on two Wealthy trees, one biennial in habit the other annual, further indicated mass behavior, especially in the case of the biennial tree. Branches from a single tree were found to possess marked individuality in respect to fruit-bud differentiation. A study of the first year's growth of Wealthy spurs showed that those arising in the heavy bearing year rarely formed fruit buds. In a Wealthy tree it was found that spurs blooming in the light year had a better chance of forming fruit buds than those blooming in the heavy fruiting year. The vegetative growth of nonfruiting spurs was found to be in inverse ratio to the yield of fruit. It was observed that thicker layers of annual growth were formed in the offyear than in the bearing year.

Chemical data are presented showing that the potassium content of the bark of scaffold limbs of bearing York trees is equal to that of the spurs, the nitrogen content half that of the spurs, and the phosphorus percentage is usually much lower in the bark than in the spurs but varies sharply at certain periods.

The results as a whole indicate that either the spur, the branch, or the whole tree may be units, and that the individual spur is influenced in some instances at least by the performance of the other spurs. The authors conclude that the factors influencing spur performance are localized narrowly at times, widely at others, and, in all cases, that studies of the factors determining fruit-bud differentiation should not be confined to the spur alone.

History and improvement of the apple, A. CHEVALIER (*Rev. Bot. Appl. and Agr. Colon.*, 1 (1921), No. 3, pp. 149-215).—A comprehensive discussion of the origin of cultivated apples, with particular reference to the cider apples of France. Descriptive data are given of many species from all parts of the world, methods of plant breeding are discussed, and sterility, parthenocarpy, grafting, etc., are fully described.

Respiration in the apple, G. RIVIÈRE and G. BAILHACHE (*Jour. Soc. Natl. Hort. France*, 4. ser., 22 (1921), Nov., pp. 363-365).—A brief report of observa-

tions made in 1913 upon the nature and amount of gases emanating from an apple of the Reinette du Mans variety stored in a bell jar.

[Report of the] **fruit and vegetable committee** ([Gr. Brit.] Dept. Sci. and Indus. Research, Food Invest. Bd. Rpt. 1920, pp. 16-25).—In storage studies with apples it was found that fruits of the Worcester Pearmain variety kept better at a temperature of 1° C. than at either 3 or 5°. No shrinkage occurred at either 1 or 3° with an 85 per cent humidity saturation; however, at 60 per cent humidity and 5° temperature there was noticeable shrinkage. Fruits were found to keep better in wood than in cardboard containers and wrapping in tissue paper tended to lengthen the keeping period. Apples of the Stirling Castle variety, stored in an atmosphere of 14 per cent carbon dioxide and 8 per cent oxygen, kept twice as long as a control lot under ordinary conditions. Apples grown in sod were found to keep better than those from tilled soil, and apples grown on clay soil apparently kept better than those grown in chalky soils.

Strawberries, raspberries, black currants, red currants, and gooseberries were successfully held by freezing in ordinary air storage for several months, whereas cherries and plums could not be kept except in an atmosphere free from oxygen—for example, nitrogen—in which situation the normal flavor was retained.

Dormancy and winterkilling of peach buds, C. H. FARR (*Iowa State Hort. Soc. Trans.*, 55 (1920), pp. 99-116).—In this investigation, conducted for the most part while the author was connected with the Bureau of Plant Industry of the U. S. Department of Agriculture, careful microscopical observations were made upon the development of the anthers of the peach in the expectancy of finding some relation between actual cessation of dormancy and the phenomena of winterkilling. Eight stages in the reduction divisions known technically as (1) synapsis, (2) diakinesis, (3) interkinesis, (4) homoeotypic, (5) quadripartition, (6) tetrad, (7) microspore, and (8) pollen grain are carefully described, and are used in the paper to express the successive gradations in the development of the pollen mother cell.

In order to determine what influence various factors, such as variety, position on the tree, etc., may have on the time of cessation of dormancy, buds from various sources were examined. In single anthers, the mother cells in every case were found in the same stage of development. This was also true in the case of 60 per cent of single buds. In the instance of twin and triple buds, as a rule little variation was noted between the individuals. On a single twig, the larger buds were usually found to be further advanced. Twin and triple buds were always less advanced than single buds, but there was no apparent relation between position on the twig and stage of development. On a single tree the buds on vigorous young shoots were almost invariably further advanced than those on stubby shoots. In examining buds on the same type of twig from separate trees of a single variety in a single orchard, no greater differences in development were observed than those found between buds of a single tree.

A study of the buds of 23 peach varieties growing at Arlington, Va., indicated marked differences in the development of pollen mother cells between varieties. In most cases those varieties showing earliest renewal of activities were among those usually considered least hardy. The author points out that cessation of dormancy occurs before indicated externally by the swelling of the buds, and that microscopical study is the only accurate method of determination. Much of the data is presented in tabular form.

One-eye grape cuttings, A. PETIT (*Jour. Soc. Natl. Hort. France*, 4. ser., 22 (1921), Nov., pp. 361-363).—A brief account of studies in methods of making and handling one-eye cuttings of the grape. Five varieties, Chasselas Rose, Frankenthal, Madeleine Angevine, Madeleine Royale, and Précoce de Malingre, all *Vitis vinifera* species, were used in the experiment.

Roots were found to develop invariably from the cut below the bud. In a determination of the proper length of cuttings it was found that 0.5 cm. (0.2 in.) above the bud and 2 cm. below were the minimums in order to have sufficient nutriment for the initial development. In comparing the oblique with the square cut, the author found that the latter was most satisfactory. The partial removal of bark or wounding in any manner was found to be detrimental to the cutting. In a comparison of horizontal, oblique, and vertical bedding, the best root development was obtained from cuttings placed in an upright position. Negative results were obtained in a test of the value of immersing cuttings in nutrient solutions for 24 hours previous to planting. The best growth occurred in the control lot which was in distilled water. In comparing clean sand *v.* sand supplemented with clay as growth media for cuttings, the best results were obtained with the mixed material. Splendid growth was obtained in a mixture of two parts of sand and one part of market garden compost.

Fruit growing in Syria and Cilicia, GOURAUD (*Rev. Bot. Appl. and Agr. Colon.*, 1 (1921), No. 3, pp. 129-148).—Data are presented relative to fruit culture in Syria and Cilicia with particular reference to species and varieties, methods of propagation, and cultural practices. The author concludes that fruit growing in these countries is, on the whole, in a most rudimentary state.

Pomological study of some Philippine fruits, L. B. VILLANUEVA (*Philippine Agr.*, 9 (1920), No. 4-5, pp. 97-110, pls. 3).—Several species of Philippine fruits, for the most part indigenous to the islands, are technically described and carefully rated as to their probable value. The investigation was conducted with a view of finding species which would merit propagation and distribution throughout the islands.

Coloring citrus fruit, L. A. HAWKINS (*Fla. Grower*, 25 (1922), No. 2, p. 5, fig. 1).—A description is given of a successful method of hastening the yellowing of certain citrus fruits which attain an edible condition before assuming a full color. The active agent in the process is an undetermined gas, easily generated in ordinary kerosene stoves operated under conditions of imperfect combustion.

The bud sport origin of a new pink-fleshed grapefruit in Florida, T. R. ROBINSON (*Jour. Heredity*, 12 (1921), No. 5, pp. 194-198, figs. 3).—An account of the origin of the pink Marsh grapefruit, a bud mutation from an ordinary Marsh tree growing near Oneco, Fla. The color of the flesh in midseason is described as a beautiful pink gradually fading in later season to an amber hue.

A physiological study of grapefruit ripening and storage, L. A. HAWKINS (*Jour. Agr. Research [U. S.]*, 22 (1921), No. 5, pp. 263-279, fig. 1).—In continuation of the previously noted studies (E. S. R., 44, p. 639), this paper discusses the effect of harvesting grapefruit at monthly intervals upon the acid and sugar contents. Based on analyses made directly upon the receipt of the fruits in Washington, D. C., and during storage at 32° and 70° F., data are presented in tabular form both upon the changes occurring on the tree during the ripening period and upon those changes occurring in the warm and cold storage.

The results of the analyses made preceding storage indicate that acidity decreases as the season advances, accompanied by a rise in the percentage of total sugars. The percentages of dry matter and of peel were highest in the fruits of the first harvest, decreasing sharply during the succeeding month, and followed thereafter by comparatively slight changes. Analyses of the warm and cold stored fruits substantiated the results presented in the previous paper.

In a test of the possibility of controlling pitting, fruits subjected to a curing process at 70° F. and an approximate humidity of 60 per cent previous to being

placed in cold storage were much freer from this blemish than untreated fruits. The author suggests the desirability of gathering grapefruit slightly before maturity, ripening in storage, in order to obtain a sweeter and more palatable product.

Pineapple culture in Florida, E. D. VOSBURY and J. R. WINSTON (*U. S. Dept. Agr., Farmers' Bul. 1237 (1921), pp. 35, figs. 31*).—Beginning with a general discussion of the pineapple industry in Florida, including history, geographical distribution, climatic and soil requirements, varieties, culture, harvesting, marketing, and pests and diseases, the authors point out the general decline of the industry, discuss causes, and suggest methods for its restoration. The three chief causes of the failure of the pineapple industry in Florida are believed to be (1) depletion of the soil humus from continuous tillage and consequent exposure to the tropical sun, (2) increase of wilt due to the attack of nematodes, and (3) the use of inferior slips in establishing new plantations. Experimental evidence has indicated that the growing of Natal grass, a practically immune plant, for a period of at least two years will largely reduce the nematodes and at the same time restore sufficient humus to the soil to enable the growing of a satisfactory crop. It is recommended that only vigorous, carefully selected slips be used for propagation.

Pollination of filberts, C. E. SCHUSTER (*Oreg. Grower, 3 (1922), No. 6, pp. 3, 5, 9, fig. 1*).—A paper pointing out the necessity of interplanting filberts, since none of the varieties now grown in Oregon are considered self-fertile. It is recommended that Barcelona, the most important variety, be interplanted with Du Chilly and other varieties. Mixed plantings are advised as a general rule, and such varieties as Clackamas, Daviana, Chaperone, and Alpha are suggested for this purpose.

First report of the tree protection examining board for the biennial period ending June 30, 1921, W. E. BRITTON (*Connecticut State Sta. Bul. 231 (1921), pp. 339-350, fig. 1*).—The text of an act which became effective July 1, 1919, requiring the examination of all parties wishing to practice tree repairing or spraying on a professional basis in the State of Connecticut is given, and operations under the act are noted.

FORESTRY.

The present situation in forestry, with special reference to State forestry, J. W. TOUMEY (*Science, n. ser., 54 (1921), No. 1406, pp. 559-566*).—In this address, delivered in the School of Citizenship, Yale University, in October, 1921, the author depicts with clear vision the status of forestry in the United States as a whole and in Connecticut in particular. He believes that the abandonment of farm areas in Connecticut was closely associated with the exhaustion of merchantable timber from the farm woodlots, and that the future development of agriculture, except in certain highly productive areas, must be correlated with constructive reforestation.

Tenth annual report of the State forester to the governor for the year ending December 31, 1920, F. A. ELLIOTT (*Oreg. State Forester Ann. Rpt., 10 (1920), pp. 60, figs. 8*).—Fire protection, as in the preceding year (*E. S. R., 43, p. 747*), continues to be the principal feature of the report. A forestry policy for the State, approved by the State Board of Forestry, is outlined and discussed.

Annual report of the director of forests for the year ended June 30, 1921, E. H. F. SWAIN (*Queensland Dept. Pub. Lands, Ann. Rpt. Dir. Forests, 1921, pp. 43, pls. 2*).—A report of the year's activities of the Queensland Forest

Service, including the usual statements (E. S. R., 44, p. 742) relative to changes in areas; silvicultural operations; forest protection, including a study of the red cedar twig borer; surveys; and general administration. Appended to the report is the first published forest map of Queensland, showing an approximate total area of 24,000,000 acres of commercial forests.

Government forest work in Utah (*U. S. Dept. Agr., Dept. Circ. 198 (1921), pp. 31, fig. 1*).—This is a small pocket-size pamphlet presenting information relative to the 7,421,191 acres embraced in the National Forests of Utah, and discussing various activities of the Forest Service in their administration.

Handbook for campers in the National Forests in California (*U. S. Dept. Agr., Dept. Circ. 185 (1921), pp. 48, figs. 17*).—Following a presentation of information relative to the location, size, accessibility, and principal features of each of the many National Forest areas in California, suggestions are offered to prospective campers relative to outfits, transportation, fire precautions, etc.

Spanish terms for forest rangers, compiled by W. SHEPARD (*U. S. Dept. Agr., Forest Serv., 1921, pp. [4]+44+10*).—A small handbook of Spanish terms and their English equivalents, prepared in multigraphed form for the use of forest officials, particularly in their relations with Spanish-speaking peoples of the Southwest.

Forest mensuration, H. H. CHAPMAN (*New York: John Wiley & Sons, Inc.; London: Chapman & Hall, Ltd., 1921, pp. XXII+553, figs. 88*).—This text, designed for the use of the forestry student, forest owner, and timber operator, is prepared in three parts, (1) the measurement of felled timber and its products, (2) the measurement of standing timber, and (3) the growth of timber. Although prepared as a successor to *Forest Mensuration*, by Graves (E. S. R., 18, p. 340), the form of presentation and much of the subject matter is entirely new.

Cottonwood for lumber production (*Iowa Sta. Rpt. 1920, p. 49*).—Measurements obtained in over 100 cottonwood plantations in various localities in Iowa indicated a volume production in mature plantations of 35 years and over of from 25,000 to 50,000 board ft. per acre. This species is deemed of particular value on lands subject to overflow at certain seasons of the year.

The maples, J. S. ILLICK (*Amer. Forestry, 28 (1922), No. 337, pp. 12-19, figs. 14*).—An illustrated, descriptive account of six maple species, *Acer saccharum*, *A. saccharinum*, *A. rubrum*, *A. pennsylvanicum*, *A. spicatum*, and *A. negundo*, known respectively as sugar, silver, red, striped, mountain, and ash-leaved maples. The distinguishing characteristics of each species are pointed out.

[**The importance and distribution of western yellow pine**], C. H. SHATTUCK (*U. S. Dept. Agr. Bul. 1003 (1921), pp. 1-13, figs. 2*).—In an attempt to emphasize the importance of better utilization of the stumpwood of western yellow pine (*Pinus ponderosa*), data are presented showing the wide range and extensive stands. It is stated that approximately 350,000 acres of this species are logged each year. Dividing the range into five areas (1) Arizona and New Mexico; (2) California; (3) Oregon and Washington; (4) Idaho, Montana, and Utah; and (5) Colorado, South Dakota, and Wyoming, estimates are given of the acreage and stand in each of these areas.

The average volume of stumpwood for the entire area is estimated at 2.5 cords per acre. It was observed that a large percentage of the stumps did not contain sufficient resin to render their utilization worth while.

American storax production: Results of different methods of tapping red gum trees, E. GERRY (*Jour. Forestry, 19 (1921), No. 1, pp. 15-24, figs. 4*).—An account of an investigation in the production of storax from the American

red gum (*Liquidambar styraciflua*), in which the yields resulting from three methods of tapping are recorded and supplemented by microscopic studies of the wood from typical trees of each treatment.

Of the three methods employed, namely, girdling and perpendicular and horizontal tapping, the last gave much the largest yield. Girdling not only gave a small yield but caused the ultimate death of the tree. In examining the wood structure it was found that more wood tissue and gum ducts were formed about the short horizontal wounds than in either of the other two operations. Practical recommendations for obtaining increased yields by careful placing of the cuts and by frequent scarification of the wounds are included.

Preliminary volume tables for second-growth redwood, D. BRUCE (*California Sta. Bul. 334* (1921), pp. 235-237).—Two volume tables are presented, the first of which is based on merchantable height to 5 in. at the top and the second on the total height. The second table was derived from the first by studying the length of top above 5 in. for various diameters and lengths. The data are based upon measurements originally obtained by the U. S. Department of Agriculture for use in an earlier publication (E. S. R., 14, p. 971).

The American walnuts, J. S. ILLICK (*American Forestry*, 27 (1921), No. 335, pp. 699-704, figs. 14).—Four species of walnuts, *Juglans nigra*, *J. cinerea*, *J. californica*, and *J. rupestris*, native of North America, are described and illustrated.

DISEASES OF PLANTS.

Botany and plant pathology (*Iowa Sta. Rpt. 1920*, pp. 31-35).—Summary accounts are given of studies on various plant diseases, among them oats rust, cabbage yellows, blackleg of cabbage, corn root rot, and *Septoria* leaf spot of wheat, and on potato seed treatment.

Biological studies of the crown rust of oats showed that this fungus would infect species of *Holcus*, *Alopecurus*, *Lolium*, *Festuca*, *Phleum*, *Anthoxanthum*, *Arrhenatherum*, *Dactylis*, and *Beckmannia*. As many of these grasses are perennial, it is thought that they may carry the rust from season to season. Studies of crown rust of oats collected in 18 localities in the western United States showed very little difference in behavior in response to different varieties of oats as compared with that observed for the species in Iowa.

Comparative tests of corrosive sublimate and formaldehyde for the control of blackleg of cabbage are said to indicate that soaking the seed for 20 minutes in a 1:1,000 solution of corrosive sublimate is to be preferred as a treatment for this seed-borne disease.

Studies were continued on the relation of discoloration of seed corn to certain diseased conditions. Ear-to-row plantings were made of discolored and not discolored grain for comparison, and it was found that the behavior in the germinator was not always confirmed in field tests. The relation of barren stalks and broken shanks to seed condition was investigated to some extent, and an attempt was made to correlate spindle sprouts and the presence of stem lesions due to *Fusarium* spp.

Field trials of the hot formaldehyde treatment of seed potatoes are said to have been very successful.

A survey of the wheat scab situation in 45 counties showed that the yield of spring wheat was reduced by this disease to the extent of 15 per cent, and winter wheat suffered losses to the amount of about 11 per cent.

Department of botany and bacteriology, D. B. SWINGLE (*Montana Sta. Rpt. 1920*, pp. 24, 25).—The author reports progress made in Montana in the

eradication of barberry bushes for the control of cereal rust. A brief account is given of studies made of fungi isolated from potato tubers, about 100 cultures having been obtained. Of these a number were eliminated, but work is in progress on the remainder, which appear to be species of *Fusarium*. An account is also given of investigations which have been in progress for some time on the brown bark spot of fruit trees, and the work is believed to have been carried on sufficiently to show that the disease is connected with some condition of the soil.

Investigations are reported on the effect of arsenic on species of bacteria that inhabit the soil and are responsible for important chemical changes, such as ammonification and nitrogen fixation. It was found that all the arsenical compounds used were germicidal, but in different degrees. When these compounds were applied to soils in a strength not quite sufficient to kill the organisms, the normal functions such as growth, gas formation, etc., were inhibited. Different species of soil organisms were found to differ greatly in their sensitiveness to arsenical compounds.

Preventable plant diseases (*Texas Sta. Rpt. 1920, pp. 32-36, fig. 1*).—Notes are given of a number of plant diseases, with suggestions for their control. Among the diseases mentioned are wilt, anthracnose, stem-end rot, and blossom-end rot of watermelons, cotton root rot, pink root of onions, black mold of ear corn, and storage diseases of sweet potatoes. More complete details of investigations of some of these diseases have already been noted (*E. S. R.*, 45 pp. 50, 247).

The author states that experiments carried on during the period covered by the report indicate that the early blight and leaf firing of tomatoes can be controlled by spraying with a 4:4:50 Bordeaux mixture without apparently delaying the earliness of ripening. Sugar-through gourd was found to be 100 per cent resistant to wilt.

Parasitic plants as enemies to crops, M. J. NARASIMHAN (*Jour. Mysore Agr. and Expt. Union*, 2 (1920), No. 1, pp. 18-20).—Mention is made, among root parasites, of *Striga lutea* on ragi, jola, and sugar cane, *Balanophora* on coffee, and sandal on various crops; among stem parasites, *Loranthus* on mango and *Viscum* on *Casuarina*. Stem and leaf parasites include *Cuscuta* and *Cassytha*, which occasionally attack avare and ragi, also *Acacia* plants near the fields.

Diseases and pests of cultivated plants in Dutch East Indies during 1919, C. J. J. VAN HALL (*Dept. Landb., Nijv. en Handel [Dutch East Indies], Meded. Inst. Plantenziekten*, No. 39 (1920), pp. 50).—Employing the plan followed in previous reports (*E. S. R.*, 41, p. 544), the author follows up a short general review with an account of diseases and pests of cultivated plants of economic importance.

A study of the toxic action of fungicides to parasitic fungi (*New Hampshire Sta. Bul. 198 (1921), pp. 8, 9*).—Preliminary to studies on the value of fungicides to destroy spores, investigations have been conducted on the cardinal temperatures of germination of spores of the following: *Cronartium ribicola*, *Gymnosporangium clavipes*, *Puccinia antirrhini*, *P. malvacearum*, and *Uromyces caryophyllinus*. The minimum temperature of germination was found to vary from 3 to 9° C., the maximum from 19 to 30°, and the optimum from 10 to 16°.

A study of certain fusarial diseases of plants, E. F. HOPKINS (*Missouri Sta. Bul. 189 (1921), pp. 30, 31*).—A report is given on the relation of hydrogen-ion concentration to the reaction of *Gibberella saubinetii*, the cause of wheat scab and corn root rot. The organism isolated from wheat was found to grow in both liquid and solid media in which the acidity was varied in different ways,

showing that it has a very wide range of tolerance for hydrogen-ion concentration. Conidial production by this organism increased markedly as the hydrogen-ion concentration increased. Two series of experiments on the relation of the hydrogen-ion concentration of the soil to seedling infection of wheat by *G. saubinetii* showed that when two different acids were used in adjusting the soil reaction a minimum was present in the acidity-infection curve at pH 5.5, which is said to be a not unusual soil reaction.

A field test on varietal susceptibility of various kinds of wheat to wheat scab were carried out. It appeared that although none of the varieties listed were scab free, some showed a much greater amount of infection than others.

Preliminary experiments on the corn root rot showed, as in the case of wheat, that the acidity-infection curve showed a minimum.

Notes on some polemoniaceous rusts, C. R. ORTON (*Mycologia*, 11 (1919), No. 4, pp. 168-180).—The author was obliged during the study of the genus *Allodus* (E. S. R., 36, p. 542) to reinvestigate some polemoniaceous rusts. The results, which are embodied in the present report, are here divided into three groups related, respectively, to *A. giliae*, *A. douglasii*, and other outstanding species.

Rostronitschkia, a new genus of Pyrenomycetes, H. M. FITZPATRICK (*Mycologia*, 11 (1919), No. 4, pp. 163-167, pl. 1).—A fungus parasitic on leaves of *Gesneria albiflora*, collected in Porto Rico in 1915, is technically described as a new genus and species under the name *R. nervincola*.

Alternaria on leaves of Nicotiana plumbaginifolia and Datura stramonium, S. N. BAL and H. P. CHOUDHURY (*Jour. Dept. Sci., Univ. Calcutta*, 2 (1920), Bot., pp. 6-9, pl. 1).—A fungus found on *N. plumbaginifolia* is described and classified as identical with or closely related to *A. violae*; one found on older leaves of *D. stramonium* is identical with *A. solani*.

A new Balansia on Cyperus, C. W. EDGERTON (*Mycologia*, 11 (1919), No. 5, pp. 259-261, pl. 1).—Fruiting parts of *C. virens* were found to be attacked severely by a *Balansia*, which is described as a new species under the name *B. cyperi*.

Grain smuts investigation and control, E. F. HOPKINS (*Missouri Sta. Bul.* 189 (1921), p. 31).—The hydrogen-ion concentration as related to the germination of cereal smut spores was investigated, and the maximum and minimum concentrations were determined for *Ustilago hordei*, *U. levis*, and *Tilletia levis*. It was found in the case of *U. hordei* and *U. levis* that with increasing hydrogen-ion concentration there was an increase in the number of sporidia, and roughly the increase in the number of sporidia was inversely proportional to the percentage of germination.

Yellows-resistant strains of cabbage (Iowa Sta. Rpt. 1920, p. 49).—Excellent progress is reported in developing a yellows-resistant strain of Copenhagen market cabbage, a field trial for resistant strains showing a stand of 78 per cent as compared with 36 per cent from commercial seed.

A possible causative agent for the mosaic disease of corn, L. O. KUNKEL (*Hawaii. Sugar Planters' Sta., Bot. Ser., Bul.*, 3 (1921), No. 1, pp. 44-58, pls. 12, figs. 2).—The author gives the results of investigations on the nature, varietal susceptibility, etc., of mosaic disease of corn and reports observing intracellular bodies invariably present in disease cells of mosaic corn plants. These bodies are irregular in shape and always occupy a position on or near the host cell nucleus. Their distribution corresponds exactly with the distribution of the light green color in diseased leaf tissue. The bodies of corn mosaic are said to show very little resemblance to the plasmodia of *Plasmodiophora*

brassicae. None of them have been grown in pure culture, and final proof that they are etiologically related to mosaic has not been produced.

Corn mosaic is said to be similar, if not identical with, the yellow stripe disease of sugar cane. In the experiments carried on a considerable number of varieties of corn have been found susceptible to the disease, and although several are somewhat resistant no variety is known to be entirely immune.

Control of downy mildew of lettuce (*Iowa Sta. Rpt. 1920, pp. 48, 49*).—It is claimed that experiments carried on at the station indicate that this disease is primarily a seedling one, and that if the plants are given two applications of Bordeaux mixture as soon as they are above ground the disease will ordinarily be controlled. Studies have also shown that the same fungus lives on wild lettuce, and the eradication of this weed from areas adjacent to greenhouses and hotbeds is important.

Relation of soil temperature and other factors to onion smut infection, J. C. WALKER and L. R. JONES (*Jour. Agr. Research [U. S.], 22 (1921), No. 5, pp. 235-262, pls. 3, figs. 2*).—In a contribution from the Bureau of Plant Industry, U. S. Department of Agriculture, a description is given of an investigation on the occurrence of onion smut due to *Urocystis cepulae* in relation to climate and cultural practices. This disease is said to be an important economic factor in nearly all northern onion-growing sections of the United States, while in the southern onion-growing sections it is of little or no consequence.

Investigations by the authors show that the cotyledon of the onion is susceptible to attacks by the onion smut organism up to the time it attains full growth. Cotyledons remaining free from infection during this period become resistant and serve as a barrier to subsequent invasion of the embryonic region of the true leaves.

Experiments were conducted to determine the relation of soil moisture, air temperature, and soil temperature to smut infection, and it appears that soil moisture is not a serious limiting factor in the occurrence of the disease. The relation of soil temperature was studied in a soil temperature tank, and it was found that seed germination and growth took place over a range of soil temperature from 10 to 31° C. Most rapid seed germination and development of tops occurred at soil temperatures of 20 to 25°, while as a rule the best development of roots occurred below 20°. A high percentage of plants grown on smutted soil were infected at soil temperatures ranging from 10 to 25°, there was a decided reduction in the infection at about 27°, and complete freedom from the disease resulted at 29°.

The relation of variations in air temperature to the development of the disease was studied, and it was found that high air temperature alone was insufficient to check the progress of the disease. Comparing the development of the disease in plants grown in air and soil temperatures of from 15 to 20° and at 24 to 28° a high percentage of cotyledon infection was observed in both cases, but at the higher temperature the plant tended to outgrow the disease, growth being associated with more rapid top development, which apparently enabled the plants to slough off the smutted cotyledons before infection of the first true leaves occurred. Successful outdoor planting at Madison, Wis., made in inoculated soil, resulted in a gradual reduction of infection as the season advanced and the soil temperature rose, and there was complete freedom from smut when the daily mean soil temperature to a depth of 2 in. remained at or slightly above 29° for two or three weeks.

An examination of records from one of the important southern onion sections showed that during a good share of the critical period for onion smut

infection the mean air temperature, and probably that of the soil, was sufficiently high that no disease resulted. It is concluded that even though the smut organism were introduced in southern onion sections, its development would be prevented or greatly minimized by the prevention of infection due to high temperature and by the rapidly developing tops outgrowing the disease.

Disease of chili pepper (*New Mexico Sta. Rpt. 1920, pp. 12, 13*).—A report is given of an investigation of the chili blight (E. S. R., 42, p. 844), with data regarding subsequent investigations on the correlation existing between the occurrence of the disease and the amount of moisture present in the soil. Plants grown in soils with less than 12 per cent moisture do not appear subject to the disease, while an abundance of the disease was noticed in every case where the soil moisture was above 12 per cent. To determine the actual relations between soil moisture and the disease a series of experiments, which are briefly outlined, has been inaugurated covering a wide range of soil moisture.

Relation of mosaic to running out of potatoes in Minnesota, F. A. KRANTZ and G. R. BISBY (*Minnesota Sta. Bul. 197 (1921), pp. 31, figs. 19*).—Some of the results are given of investigations that have been in progress for a number of years on the nature of "running out" of potatoes and the way in which it is transmitted. The authors state that probably the most important factor in Minnesota is the mosaic disease, and for the more severe symptoms they have used the term "mosaic dwarf."

Mosaic is not considered a new disease of potatoes, and it is believed to have been introduced into this country through the importation of varieties. Mosaic dwarf is said to be perpetuated from year to year by planting tubers from diseased plants. It may be transmitted artificially by transferring the juice from diseased to healthy plants or by grafting a portion of a diseased plant on a healthy one. The virus producing the disease was not found to spread through the soil when healthy and diseased plants were grown side by side with their roots allowed to intermingle. Some evidence is presented to show that healthy plants will not contract the disease if insects are excluded from them. A large number of varieties of potatoes have been tested, and no varieties were found to be immune from mosaic dwarf. Selections to isolate resistant strains within varieties failed. It is thought possible to control mosaic by growing disease-free seed stock in a plat isolated from possible sources of infection.

A contribution to a check list of sugar cane fungi, compiled by E. L. CAUM (*Hawaii. Sugar Planters' Sta., Bot. Ser., Bul., 3 (1921), No. 1, pp. 66-97, figs. 7*).—A list is given of fungi which have been reported as occurring on sugar cane, either as parasites or saprophytes, the fungi being listed alphabetically by genera.

Three major cane diseases: Mosaic, sereh, and Fiji disease, H. L. LYON (*Hawaii. Sugar Planters' Sta., Bot. Ser., Bul., 3 (1921), No. 1, pp. 1-43, pls. 4, figs. 27*).—Descriptions are given of mosaic, sereh, and Fiji diseases of sugar cane. Of these diseases, which are said to be infectious, only the mosaic disease is definitely known to occur in Hawaii. No cane variety grown commercially in Hawaii is known to be immune to mosaic, but a few varieties are quite resistant to the disease. This disease, it is said, may be controlled by the use of resistant varieties, and by planting cuttings from healthy canes.

The sereh disease, which was previously reported as occurring in Hawaii, is now believed not to be present in that territory. The causative factor of this disease is not definitely known, nor has the disease any strictly unique symptoms by which it can be readily differentiated from other diseases. Sereh causes a pronounced stunting of the stools in some varieties of sugar cane, and

the growth of adventitious roots from the aerial nodes is often induced by this disease. It is said to be transmitted through cuttings, the symptoms becoming more pronounced in each succeeding generation. The use of resistant varieties, the planting of healthy canes, and the abandonment of ratooning, are said to be methods of control.

The Fiji disease, which occurs in New Guinea, Australia, Fiji, and the Philippines, may be recognized by the pronounced swellings or galls in the vascular bundles of the stems and leaves. A foreign body, simulating a plasmodium, occurs in each cell of the gall tissue, and is considered to be the parasitic agent responsible for the disease. The author states that the disease is controlled in Fiji by planting resistant varieties, by using cuttings from healthy canes, and replanting all fields after but one ratooning crop.

Morphological studies of the Pythium-like fungi associated with root rot in Hawaii. C. W. CARPENTER (*Hawaii. Sugar Planters' Sta., Bot. Ser., Bul., 3 (1921), No. 1, pp. 59-65, pls. 8*).—In continuation of studies on a Pythium-like root rot of various plants in Hawaii (E. S. R., 44, p. 47), the author has made further investigations, particularly on a root rot disease of sugar cane commonly known in Hawaii as Lahaina disease. He has found the fungus to be morphologically identical with *Rheosporangium aphanodermatus* (E. S. R., 33, p. 648), but prefers to classify the fungus in the genus *Pythium* and refers it to *P. butleri*. The Pythium-like fungus previously reported as associated with the root rot of pineapples and rice is said to be similar in its morphology to that occurring in sugar cane. The fungus previously reported as causing a root rot of taro was found to be a conidium-producing Pythium.

Fiji disease controlled by seed selection (*Sugar Cent. and Planters News, 2 (1921), No. 8, pp. 335, 336*).—Letters published from D. S. North and O. A. Reinking indicate that Fiji disease has been brought under control in Fiji mainly by seed selection, and that infection from the soil is not to be feared, but that danger exists of propagating the disease by cuttings and possibly of infection from plant to plant, perhaps by means of insects as carriers. Cuttings brought from Mindoro and Calamba to Los Banos, and planted on the side of the mountain where no sugar cane had been growing, produced in each case a plant showing typical Fiji disease.

Yellow stripe or mosaic of sugar cane, O. A. REINKING (*Sugar Cent. and Planters' News, 2 (1921), No. 5, pp. 190, 191*).—The author has been able to confirm the statement (E. S. R., 46, p. 46) regarding the presence of yellow stripe on sugar cane, this disease having been identified in many suspected cases, especially on seedling cane grown at the College of Agriculture at Los Banos and elsewhere.

The trouble is most severe on Lahaina cane. Others are affected. Philippine cane does not show very severe attack.

Another foreign cane disease recently imported [into the Philippines], H. A. LEE and M. G. MEDALLA (*Sugar Cent. and Planters' News, 2 (1921), No. 5, pp. 193, 194*).—Some sugar-cane varieties imported late in 1919 or early in 1920, planted on the Tagawa estate near San Mateo, Rizal Province, among commercial canes, developed in April a leaf stripe said to be not identical with the yellow stripe noted previously (E. S. R., 46, p. 46) as already prevalent in that locality. The disease is treated in this statement as identical with downy mildew, said to be present in Taiwan, Fiji Islands, and Queensland, and to cause losses ranging from 5 to 15 per cent each year. Protective measures are outlined.

Disease notes of 1921; outlook for next season, R. C. THOMAS (*Ohio Sta. Mo. Bul., 6 (1921), No. 9-10, pp. 153-157*).—A brief review is given of the

plant disease situation during 1921 with reference to diseases of fruits. On account of the freeze early in the year, the fruit crop throughout a considerable portion of the State was more or less of a failure and as a result the usual attention was not given orchards. On this account the author believes that the season of 1922 will be characterized by the presence of many diseases resulting from the amount of infectious material that has been allowed to accumulate in orchards.

Fire-blight distributors, R. C. TREHERNE (*Brit. Columbia Dept. Agr. Ann. Rpt.*, 14 (1919), p. 50).—Preliminary studies to determine what insects spread fire blight gave negative results in case of most insects with which experiments were conducted. *Empoasca mali*, *Aphis mali*, and *Lygus pratensis* have been shown to be blight distributors. Others more or less concerned in fire blight distribution include ants, honeybees, click beetles, apple aphids, and bark beetles.

Apple blister canker and its control, J. D. LUCKETT (*New York State Sta. Bul.* 485, pop. ed. (1921), pp. 3-12, pls. 7).—This is a popular edition of the bulletin previously noted (*E. S. R.*, 45, p. 652).

Plum blotch, a disease of the Japanese plum, caused by *Phyllosticta congesta*, J. W. ROBERTS (*Jour. Agr. Research [U. S.]*, 22 (1921), No. 7, pp. 365-370, pl. 1, figs. 2).—In a contribution from the Bureau of Plant Industry, U. S. Department of Agriculture, the author describes a plum blotch that has recently been found in Georgia. In addition to the fruit, the leaves and possibly the twigs are affected. The lesions resemble those produced by *P. solitaria* on the apple.

The fungus, *P. congesta*, was isolated from diseased fruits and leaves and grown in pure culture. Inoculation experiments resulted in characteristic lesions in both healthy fruits and leaves. The author considers that *P. congesta* is not identical with *P. solitaria*, though greatly resembling it.

Macrosporium growing on *Citrus medica acida* and other species of *Citrus*, S. N. BAL (*Jour. Dept. Sci., Univ. Calcutta*, 2 (1920), Bot., pp. 1, 2, pl. 1).—A leaf fungus, apparently both superficial and intracellular, on *C. medica acida* and *Citrus* spp. is briefly noted. The fruits are reduced as to both number and size by the attack. The fungus is said to be closely allied to *M. solani*, or perhaps identical therewith.

Exoascus on *Nephelium litchi*, S. N. BAL (*Jour. Dept. Sci., Univ. Calcutta*, 2 (1920), Bot., pp. 3-5, pl. 1).—Descriptive discussion is given of a local attack on leaves of *N. litchi* by a fungus said to be identical or closely related with *Exoascus deformans*, which is briefly discussed in this connection.

Diseases of the oil palm in West Africa, E. M. WAKEFIELD (*Roy. Bot. Gard. Kew, Bul. Misc. Inform.*, No. 9 (1920), pp. 306-308, pl. 1).—Oil palm diseases reported as now common and widely distributed include a trunk rot ascribed to *Ganoderma* sp. A bud rot is indicated of unknown causation from which palms do not recover. The possible agency of boring beetles is briefly discussed.

Pineapple fungus or enfant de pin or wabadou, J. H. FAULL (*Mycologia*, 11 (1919), No. 5, pp. 267-272).—The author has brought together the available information regarding *Fomes officinalis* in America.

An undescribed timber decay of hemlock, E. WEST (*Mycologia*, 11 (1919), No. 5, pp. 261-266).—A rot destroying dead hemlock timber near State College, Pa., during recent years seems to be constantly associated with sporophores of *Polyporus tsugae*. Though at first a sap rot, it eventually invades the heartwood. Primarily a cellulose destroyer, it soon attacks also lignified structures. The rot is said to be very similar to that caused by *P. borealis* in the same host.

Selection in Hevea, R. D. RANDS (*Dept. Landb., Nijv. en Handel [Dutch East Indies], Meded. Inst. Plantenziekten, No. 42 (1920), pp. 14, figs. 2*).—An account is given of experiments made at Buitenzorg, which are claimed to have resulted in the isolation of high-yielding trees resistant to brown bast. The plan, as applied to trees giving a high yield, consists simply in overtapping the trees until those which are susceptible to brown bast develop that disease, thus indicating the resistant individuals, which are then to be used for the purpose of propagation.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

Two years with the birds on a farm, E. H. FORBUSH (*Mass. Dept. Agr., Econ. Ornithol. Bul. 4 (1920), pp. 42, pls. 3, figs. 5*).—This bulletin is based upon observations conducted at Wareham, Mass., previously reported (*E. S. R.*, 15, p. 228).

[**Report of the department of**] **entomology** (*Iowa Sta. Rpt. 1920, pp. 39-42*).—Observations indicate that curly dock is an important host plant of the potato leafhopper. Scattered females were observed on dock several days previous to their appearance on the potato and were found living and producing on this common weed long after the late potatoes had been killed by frost. There was found to be but one complete generation and a partial second during the year. The overwintering females had an unusually long oviposition period, living until the first week in August and producing as high as 140 fertile eggs, whereas but few eggs were laid by the summer generation of females. Further experiments on the relation of the leafhopper to tipburn and the control of the leafhopper are considered. A progress report of the season's work, by Fenton, has been noted (*E. S. R.*, 45, p. 152).

Life history studies during the year of a native corn borer related to the European corn borer definitely proved that there are two complete generations in Iowa.

A study of the honeybee revealed the fact that half of the bees of colonies under observation made 12 or less trips a day, while the other half made from 12 to 24, the average for all being 13 trips. The longest time recorded for a round trip was 3 hours, but the average was about 45 minutes. Exactly half of the records showed less than 30 minutes spent in the field, while the average was 34 minutes. Over half the records showed less than 5 minutes spent in the hive between trips, although the average was 11 minutes. The average time of beginning work in the field was found to be about 8 a. m. and the average time of quitting was shortly after 6 p. m., making a 10-hour working day. It was found that a bee can carry a load of ripe honey equivalent to more than 90 per cent of its own weight. Bees taken from an issuing swarm were found to carry honey to the extent of three-fourths of their own weight, so that in determining the number of bees in such a swarm, one should allow only 3,000 to the pound instead of 5,500, as is the case when the bees are empty. The weight of pollen loads carried by bees was found to vary with the source, ranging from 12 mg. for elm and corn up to 25 mg. for apples and 30 mg. for hard maple. Thus the maximum load of pollen was found to be about one-third of the weight of the bee and less than half that of a maximum load of nectar. Some bees were found that carried both pollen and nectar on the same trip when working on certain kinds of honey plants.

[**Report of the division of entomology at the Missouri Station**], L. HASEMAN ET AL. (*Missouri Sta. Bul. 189 (1921), pp. 35-38, fig. 1*).—Although the year 1920 was an abnormal one as regards development of the Hessian fly and of the crop, it was shown by tests in 8 localities that the fly-free dates worked

out are effective for fly control and safe for maximum yield if the soil and seed bed are proper.

In control work with the boll worm seven varieties of corn, planted at the normal time, were treated as follows: One-third sprayed with 1 lb. of dry arsenate of lead to 50 gal. of water as the first silks appeared and repeated in a week; a second third dusted with one part arsenate of lead and one part air-slaked lime on the same dates as the spraying; and the other third left untreated as a check. An examination made as the corn was gathered in the fall showed the following damage: Sprayed corn 4.77 per cent, dusted 9.88 per cent, and check 12.2 per cent.

Work with the codling moth has shown the greatest percentage of clean fruit to have been obtained by using 100 lbs. pressure and the disk and Bordeaux nozzles, and the smallest percentage of clean fruit when the spray gun was used at 250 lbs. pressure and 100 lbs. pressure. The results are said to consistently show that a low to moderate pressure gives better results in codling moth control than does the high pressure.

The San José scale still continues to cause the greatest amount of injury to nursery stock in the State. The best method of control consists in dipping the stock in a solution of miscible oil at a strength of 1 gal. of oil to 12 to 15 gal. of water.

[Report of the] department of entomology (*New Hampshire Sta. Bul.* 198 (1921), pp. 10-12, 18).—In experiments conducted during the summer of 1919 the insecticidal properties of tobacco dust and lime and their value as a control measure for root maggots were studied. Two grades of tobacco dust, one ground to a condition resembling flour, the other coarsely ground, were used on cabbage and radish. No considerable difference was observed in their repellent qualities.

In experiments in which tobacco dust was diluted with agricultural lime, it was found that the dilution could be carried to four parts of lime to one part of tobacco dust without a serious loss to its insecticidal properties. A comparison of the relative effect of two applications as compared with one indicates that an efficient degree of repellent protection is better secured by a combination of greater dilution applied twice than by a combination of less dilution applied once. The average percentage of infestation in all check rows of radish in 1919 was approximately 70 per cent, whereas the percentage in rows treated with tobacco dust and diluted lime ranged as low as 18 per cent.

Termites attacking the beams, partitions, and flooring in the basement of a hospital building were controlled by the application of heat.

The preparation of nicotin dust as an insecticide, R. E. SMITH (*California Sta. Bul.* 336 (1921), pp. 261-274).—The author, the originator of the standardized nicotin dust, first discusses the need for and work that led to the preparation of this insecticide. Then follow accounts of the best material for nicotin dust, the chemical and physical nature of the filler, materials which have been tested, the use of poisons other than nicotin, the manner in which nicotin dust can be improved and cheapened, the possibility of reducing the cost of manufacture, the suggestion of a new type of dusting machine, a list of the insects against which nicotin dust has been used with promising results, etc.

Wheat insect survey of 1921.—Some Hessian fly in northwestern Ohio; other pests increasing, H. A. GOSSARD (*Ohio Sta. Mo. Bul.*, 6 (1921), No. 7-8, pp. 108-110, figs. 2).—This is a report of work conducted cooperatively by the station and the State department of agriculture, in continuation of that previously noted (*E. S. R.*, 44, p. 163), in which wheat fields in 31 counties were examined with a view to determining the status of wheat insects.

The emergence of the Hessian fly in the spring of 1921 was nearly a month earlier than usual, and the eggs were hatching about the time some heavy late frosts occurred. Late seeding and the spring freeze made it necessary for the parasites to concentrate on the flaxseeds available, and, as a result, parasitism and natural causes of deaths were very high, or from 60 to 90 per cent, the average for nine counties examined at the time of writing being 82 per cent. A comparison of the records of the average infestation of wheat by the Hessian fly in the counties surveyed with those of the previous year show a fall of from 44 to 17 per cent, and the percentage of parasitism has risen greatly.

Brief reference is made to the chinch bug, wheat midge, and jointworm.

Insects which attack the avocado in Florida, G. F. MOZNETTE (*Fla. State Hort. Soc. Proc.*, 33 (1920), pp. 73-76).—This is a brief account of the more important insect enemies which attack the avocado in Florida and the means recommended for their control. Previous papers on the subject by the author have been noted (E. S. R., 45, p. 551).

Some fundamentals of grove pest control, W. W. YOTHERS (*Citrus Indus.*, 2 (1921), No. 10, pp. 9-11, 23).

Plant lice injurious to apple orchards—III, The delayed dormant spray for the control of rosy and green apple aphids, F. Z. HARTZELL and L. F. STRICKLAND (*New York State Sta. Bul.* 487 (1921), pp. 5-41, pls. 4, fig. 1).—In the investigation here reported, continuing earlier work (E. S. R., 42, p. 360), much of the data is presented in tabular form.

It was found that the rosy aphid (*Aphis sorbi* Kalt.) can be controlled for the entire season by means of the delayed dormant spray, providing the trees are well pruned and that a spray toxic to the aphids is thoroughly applied when the young leaves of the terminal buds have protruded about $\frac{1}{2}$ in. This spray also destroys the green apple aphids that are on the buds when the application is made. Summer migrants, however, frequently reinfest the trees and occasionally develop in destructive numbers on the fruit clusters and make a supplementary spray during midsummer desirable.

A mixture consisting of lime sulphur, $2\frac{1}{2}$ gal.; nicotine sulphate, $\frac{3}{4}$ pint; and water to make 100 gal. has proved most efficient. Where the San José scale is present the amount of lime sulphur should be increased to 11 gal. A thorough application was accomplished when the operator was on the ground, using a properly adjusted spray gun fitted to 50 ft. of hose and a machine which delivered the spray at a pressure of from 200 to 300 lbs., and when each tree was sprayed systematically, a plan for which is described. Applications made with the nozzleman on the top of the spray tank result in failure, because of the inability to place the spray on the leeward and undersides of the buds where most of the aphids are found. The spray gun is an efficient appliance to secure thoroughness of application, because in its operation the volume of spray can be diverted from branch to branch by a slight movement of the gun. The experiments show that from $7\frac{1}{2}$ to $14\frac{1}{2}$ gal. of material are necessary in order to wet every portion of a large tree.

The introduction of *Aphelinus mali* into Uruguay to combat the woolly apple aphid, and some observations on its biology, R. SUNDBERG and A. TRUJILLO PELUFFO (*Uruguay Defensa Agr. Bol. Mens.*, 2 (1921), No. 3, pp. 65-81, figs. 14).—This is a report of studies of *A. mali*, including its introduction into Uruguay from the United States for use against the woolly apple aphid and observations of its life history.

Some nondiaspine Coccidae from the Malay Peninsula, with descriptions of apparently new species, H. MORRISON (*Philippine Jour. Sci.*, 18 (1921), No. 6, pp. 637-677, pl. 7, figs. 13).

Codling moth investigations (*New Mexico Sta. Rpt. 1920, pp. 27, 28*).—The life history investigations of the codling moth were brought to an end at the close of the season 1919, but spraying investigations were continued in 1920. Out of 4,827 larvae that entered hibernation in the fall of 1918, 57.77 per cent pupated, and 27.82 per cent emerged as adults in the spring of 1919, of which 758 were females and deposited a total of 3,290 eggs. The first emergence of adults began on April 10, and the first eggs were deposited on April 17. The last of the spring brood moths emerged May 28, and the last of their eggs were deposited May 29. The first brood moths began emerging June 7, the second brood July 20, and the third brood August 20. The average length of the different stages in the life cycle of the codling moth for 1919 is shown in tabular form.

Pale western cutworm (*Porosagrotis orthogonia* Morr.), J. R. PARKER, A. L. STRAND, and H. L. SEAMANS (*Jour. Agr. Research [U. S.], 22 (1921), No. 6, pp. 289-322, pls. 3, fig. 1*).—This is a summary of the present status of knowledge of this pest, based upon the literature and investigations conducted by the authors under the auspices of the Montana Experiment Station. Technical descriptions are given of the several stages, including 8 larval instars. A list is given of 18 references to the literature cited, and a colored plate with illustrations of the stages of the pest are included. A circular giving the main results of the investigation has been noted (E. S. R., 44, p. 757).

Rate of multiplication of the Hessian fly, W. R. McCONNELL (*U. S. Dept. Agr. Bul. 1008 (1921), pp. 8*).—This is a report of observations by the late author, made during the course of investigations of the Hessian fly at the field station of the Bureau of Entomology of this Department at Carlisle, Pa. Following an account of the methods of investigation, the author reports upon the average number of ova for the principal broods, data related to which are presented in tabular form.

It appears that the rate of multiplication is quite different in the two principal broods, the spring brood laying on an average only about 230 eggs per female, whereas the fall brood lays about 285 eggs per female. The capacity for reproduction also varies with a number of other factors, such as date of sowing, number of puparia per tiller, etc. Because of these various influences the actual rate of multiplication will vary from year to year and even from field to field, and in years of light infestation the figures will prove too low. The proportion of males to females varies in the two principal generations. In the spring generation about 60 per cent of the flies are females, while in the fall generation the sexes are approximately equal in number.

Report on the control of the imported onion maggot (*Hylemyia antiqua*), M. H. RUHMANN (*Brit. Columbia Dept. Agr. Ann. Rpt., 15 (1920), pp. Q57-Q61*).—This is a report of life history studies of the onion maggot in 1919 and 1920 and of control work conducted, consisting of comparative tests of trap crops and baits.

The onion seeding was completed in 1920 on April 12, and at regular intervals of approximately 100 ft. throughout the entire field trap onions were planted at a distance of about 2 in. in the row. There were 3,150 ft. of trap onions in the 9-acre field, or approximately 15,750 plants. A total of 410 eggs were deposited between May 15, when the first adults were observed in the field, and June 12 on six trap onions, which were selected for their bunchy leaf growth close to the ground level, the number on each varying from 10 to 79. These trap onions, set at an average depth of 1.5 in., were removed on June 14 and no further eggs were found on them, but 34 larvae which had escaped observation were found, making an average of 74 eggs that had been laid on each plant.

A careful survey made of all the volunteer trap onions in their rows showed that only 940 of the approximate total of 15,750, or about 6 per cent, were of suitable type. Six rows, each 10 ft. long, of seedling onions in different parts of the field were staked on May 15, and egg counts were made before thinning and before the destruction of the trap crop, namely, from May 19 to June 12, with the result that but a single egg was found on the 6 rows. Examinations made on June 7 of 10 full rows of seedling onions, each 315 ft. long, gave an infestation of 0.18 per cent.

The results obtained indicate that the value of the trap crop in control of the onion maggot is very great, it being pointed out that 1920 was not considered a bad maggot year. The cost of applying cull onions as trap crops was slight, requiring only 4 men for 2 days in planting and 4 men for 1 day in destruction on 9 acres. The method shows great promise and local growers are said to be satisfied with the results.

Hopkins host-selection principle as related to certain cerambycid beetles. F. C. CRAIGHEAD (*Jour. Agr. Research* [U. S.], 22 (1921), No. 4, pp. 189-220).—The principle, as defined by A. D. Hopkins in 1916, that an insect species which breeds in two or more hosts will prefer to continue to breed in the host to which it has become adapted, led to the inauguration of a series of experiments in 1914 with insects which infest two or more species of wood. In the investigations, which were conducted at East Falls Church, Va., *Xylotrechus colonus* Fab., *Cyllene pictus* Drury, *C. crinicornis* Chev., *Callidium antennatum*, *C. janthinum* Lec., *Hylotrupes ligneus* Fab., *Neoclytus capreae*, *Molorchus bimaculatus* Say, *N. erythrocephalus* Fab., *Liopus alpha*, and *Hyperplatys maculatus* Hald. were observed.

"In practically all the species experimented with the adults show a marked predilection for the host in which they have fed as larvæ, provided they are not deterred by other factors such as the unfavorable condition or the small quantity of the host. There is considerable variation in the degree of preference for the original host, as between different species. Thus: (a) Certain species are capable of living in only one genus or species of plant, which consequently they select; (b) certain species, chiefly those living in nature in several hosts, can be forced to adopt a new host; (c) certain species, chiefly those feeding in nature in a great variety of plants, show little discrimination in the selection of hosts; and (d) certain species feeding in nature in a great variety of hosts often show a preference for a few of these.

"In forced transference of individual adults of a species to a new host, a high mortality of the broods usually occurs, especially in the case of eggs laid by beetles emerging from the original host, in which case the mortality is often total. One-half to full-grown larvæ, however, usually can be successfully transferred to a new host and live and transform to adults. With some species that can be reared in a secondary (new) host, by the larvæ feeding one or part of one year, preference for that host is shown by the resulting adults. In general, the fewer the hosts in nature the more marked the predilection for a particular host, and vice versa. Continued breeding in a given host intensifies the preference for that host. The condition of the host has a great influence on host selection, in that every species prefers an optimum condition of the host which it selects and will choose a new host in the optimum condition in preference to an old host in which the conditions are unfavorable. The quantity of wood at the disposal of the ovipositing adults may influence the insects in their choice between different kinds of host wood, in that, if there are many adults to a limited amount of the primary host, some species will select a secondary host if such is available. If this is done, however, the resulting brood is weakened."

The cabbage seed stalk weevil (*Ceutorhynchus quadridens* Panz.) an important pest of cabbage seed plants on Long Island, I. H. VOGEL (*Canad. Ent.*, 53 (1921), No. 8, pp. 169-171).—This stalk weevil is an European insect, first reported from the United States in 1894 by Slingerland in Bulletin 78 of the New York Cornell Experiment Station (E. S. R., 6, p. 911), it having been found on Long Island infesting cabbage seed stalks.

There seems to have been but little published on its life history. During the season of 1920 the author made observations of it in the cabbage fields in the vicinity of Mattituck, Long Island. Eggs were first observed in the field on May 18 on the under side of the midrib of young and old cabbage plants, nearly every plant containing eggs. They were laid in punctures, the number in each puncture varying from three to seven, and were found to hatch in about four days, deposition having apparently begun not later than May 16. Oviposition continued up to May 26 but was not observed. The larvæ enter the midrib through the puncture and burrow therein, extending their work down to the pit of the branches and main stalk. Instances were observed where there were more than 30 larvæ in a leaf midrib 2.5 in. in length, and 150 larvæ were found in a single plant. The larval period occupies about 10 days, after which they emerge by boring small holes in the side of the stalk or branch, drop to the ground, and pupate near the surface of the soil in brown, fragile pupal cells made of earthen material. The adults were found in the field from June 16 to July 10. The winter is undoubtedly passed in the adult stage, although no trace of the pest could be found after it disappeared from the fields in July.

Due to the fact that cabbage seed growers on Long Island either fail to recognize this insect or confuse it with the larval stage of the common cabbage maggot (*Phorbia brassicæ* Bouche), little information has been secured relative to its distribution and destructiveness in the past. During the season of 1920 it seemed to be quite generally distributed in cabbage fields in the vicinity of Mattituck, and characteristic signs of its presence were seen in nearly every field in that vicinity.

The losses to the cabbage seed grower are due to the larvæ burrowing in the pits of the main stalks and branches, thus weakening the plant and causing it to break over or die prematurely. In either case the quantity and quality of seed produced by an infested plant is inferior to that of a plant not infested. Counts made in five fields with a view to determining its importance resulted in the finding that 47 per cent of the plants were injured to some degree. At harvest time 100 normal plants and an equal number of plants attacked by the insect were thrashed, and it was found that plants not attacked yielded 33.5 per cent more seed than plants attacked. Since there were 47 per cent of the plants attacked and the yield was 250 lbs. per acre, the loss would be 16 per cent of the crop, or 40 lbs., worth \$50 per acre, in 1920. It is pointed out that some growers have cited instances where in previous years this insect probably occasioned the loss of entire crops.

Biology of *Embaphion muricatum*, J. S. WADE and A. G. BÖVING (*Jour. Agr. Research* [U. S.], 22 (1921), No. 6, pp. 323-334, pls. 2, figs. 3).—The larvae of *E. muricatum* Say, originally described from Arkansas by Say in 1824, and related species of false wireworms have during the past six or seven years caused considerable damage to growing wheat and other field crops throughout the semiarid and middle western United States, particularly in the western half of Nebraska, Kansas, Oklahoma, and the eastern third of Colorado and New Mexico. Its principal damage is caused by the larva during the fall in devouring recently sown or newly sprouted wheat grains soon after the seed wheat has been drilled.

Technical descriptions are given of the egg, mature larva, and adult. The eggs are deposited in loose, dry, or slightly moist soil at a depth of $\frac{1}{4}$ to 1 in., sometimes singly but more often in clusters of 2 or 3 to a dozen or more eggs at one place. At temperatures ranging from 80 to 90° F. the average period of incubation is approximately 10 days. The average length of the larva stage of 31 individuals hatched out in June and kept at an average temperature of 68° was about 79 days, while in another experiment consisting of 49 larvae, kept under similar conditions, it varied from 76 to 96 days, with an average of 85 days. Under laboratory conditions the pupal stage was passed in from 18 to 20 days.

The parasite *Perilitus cleodis* Vier. was reared October 23 from adults collected from barley at Colby, Kans., August 25. As regards control measures it is pointed out that a systematic rotation of crops is one of the most effective measures in cutting down damage. The maximum injury may always be found upon those areas where the ground has been cropped to wheat continuously for several years, whereas the minimum injury is found where corn, kafir, milo, and other crops are grown which require some degree of cultivation during the growing season. That the beetle is wingless is an important factor in limiting its migration. Plowing in the late fall or early spring was found to be of considerable value in the control of this pest in the soil, the pupal cells being crushed and the pupae buried or thrown out upon the surface. Experiments in combating larvae by means of poisoned bran mash failed to give satisfactory results, as did late sowing of wheat in the fall unless the season is a very dry one.

Sulphur compounds for rust mites, W. W. YOTHERS (*Fla. State Hort. Soc. Proc.*, 33 (1920), pp. 128-133).—"It is reasonably certain that dry sulphur compounds if used on the basis of their sulphur content will give satisfactory results in controlling rust mites. In all practical tests where these were used so that the sulphur in solution was very much less than that contained in lime-sulphur solution the latter showed up somewhat better. Future experiments may show that these can be used slightly under the sulphur content basis. No injury followed any test.

"It is very doubtful if dry soda sulphur can be used on the sulphur content basis because of liability to damage. It is our opinion that this form fills a most important place in that it mixes thoroughly with all oil emulsions, thus making a combination spray for white fly, scale insects, and rust mites. We advise the citrus growers to try out on a small scale all these dry forms on two distinct bases, namely, on sulphur content basis and on cost basis."

FOODS—HUMAN NUTRITION.

Food chemistry in the service of human nutrition, H. C. SHERMAN (In *Harvey Society Lectures, 13-14. ser., 1917-18, 1918-19. Philadelphia and London: J. B. Lippincott Co., 1920, pp. 97-123*).—In this lecture, delivered before the Harvey Society of New York on January 12, 1918, the author discussed the application of food chemistry to problems of human nutrition with special reference to the economic aspects of the food situation at that time.

Flora of corn meal, C. THOM and E. LEFEVRE (*Jour. Agr. Research [U. S.]*, 22 (1921), No. 4, pp. 179-188).—This contribution from the Bureau of Chemistry, U. S. Department of Agriculture, consists of the report of a study of the flora of the corn meal used in the investigation of the keeping qualities of corn meal in storage, previously noted (E. S. R., 45, p. 259).

Although within the range of composition found in merchantable meals no bacterial activity could be detected, considerable numbers of molds and bacteria were generally present. The molds included *Fusarium* sp., *Aspergillus repens*, *A. flavus*, *A. tamari*, *A. niger*, *Citromyces* (or *Penicillium* section *Citromyces*) sp., *Penicillium oxalicum*, *P. luteum* varieties, *Mucor* sp., *Rhizopus nigricans*, and *Syncephalastrum* sp., together with various yeasts and yeast-like fungi. Of the bacteria the colon-aerogenes group and lactobacilli were most abundant in the fresh meal.

At a moisture content of over 13 per cent *A. repens* is an active agent of spoilage. Several other species of molds become active at a moisture content of 16 per cent. Other species of molds and some bacteria develop when the moisture reaches 18 to 20 per cent.

Many samples of corn were found to carry extensive mold infections, especially in the germinal area and in the tip of the kernel, sections which are removed in varying degrees by different milling systems.

On the preparation of a soluble protein extract from soy beans, S. A. WAKSMAN (*Soc. Expt. Biol. and Med. Proc.*, 18 (1921), No. 7, pp. 219, 220).—The author, from the New Jersey Experiment Stations, reports briefly the preparation from ground soy bean cake of an extract containing 45 or more per cent of soluble proteins and protein degradation products and quite rich in vitamins. The method consists briefly in using the ground soy bean cake as a substratum for the growth of the proteolytic enzymes of fungi, and after an incubation period of about 36 hours adding water to the mass and allowing the enzym present in the mycelium to act upon the proteins. The possibility is suggested of using such an extract properly modified by the addition of salts as a substitute for meat extract or digested meat products and in diabetic cookery.

Insects as food, J. BEQUAERT (*Nat. Hist.*, 21 (1921), No. 2, pp. 191–200, figs. 8).—In this article the author discusses the use of insects for food in recent and early times, and summarizes much information on flavor, methods of preparation, and other such matters.

[Insects as food] (*Nat. Hist.*, 21 (1921), No. 2, p. 206).—A note supplementing above paper.

Animal calorimetry.—XVII, The influence of colloidal iron on the basal metabolism, E. LANGFELDT (*Jour. Biol. Chem.*, 47 (1921), No. 3, pp. 557–563).—The intravenous injection of colloidal iron in dogs caused an increase of the O_2 consumption and the CO_2 production. The increased metabolism coincided with a slight increase in the respiratory quotient. There was no marked increase of the protein metabolism, the chief increase in the total heat production falling on the nonprotein metabolism.

The use of vitamin food tablets as an aid toward conserving the food supply, J. F. MCCLENDON (*Science, n. ser.*, 54 (1921), No. 1400, p. 409).—This argument for the use of vitamin tablets is based upon the necessity in the conservation of food in some cases of removing or destroying the vitamin-containing materials, as in bolted flour, refined sugar, hydrogenated fats, etc., and upon the belief that the dietary habits of various persons form an obstacle to the consumption of sufficient vitamins. Tablets suggested are orange peelings ground in a meat chopper, dried in a coffee mill, and made into tablets by the addition of dehydrated orange juice, and ground dehydrated spinach made into tablets with dehydrated orange juice.

The formation of vitamin A in living plant tissues, K. H. COWARD and J. C. DRUMMOND (*Biochem. Jour.*, 15 (1921), No. 4, pp. 530–539, figs. 3).—The authors have attempted to trace the origin of the fat-soluble vitamin in plants by testing seeds, germinated seeds, etiolated seedlings, green seedlings,

and older green plants for the relative content of vitamin A by the usual feeding experiments with rats. A change in the method of purifying the basal diet from traces of vitamin A is noted as follows: The caseinogen, instead of being extracted with alcohol and ether as formerly, is exposed in shallow layers to air at a temperature of 105° C. for at least 24 hours. This simplified method is said to yield results quite as reliable as the older method.

Preliminary tests indicated the absence of vitamin A in the seeds of turnip, cabbage, white maize, and sycamore, and its presence to a greater or less extent in peas, yellow maize, and carrots. Grass seeds and shoots were refused by the rats. No increase in the amount of vitamin A in the germinated seeds could be detected. The results with etiolated seedlings administered in amounts of about 0.7 gm. per day were somewhat inconclusive, but later more carefully controlled experiments indicated that the content of vitamin A is not appreciably greater in the etiolated seedlings than in the original seeds. Green shoots of turnip, maize, and peas (soil and sand grown) were decidedly richer in vitamin A than the original seeds or etiolated seedlings. Positive results were not obtained with carrot seedlings. A more detailed study with the sunflower confirmed in general the preliminary results. The dry seeds and etiolated shoots were relatively inactive, while the green shoots were very active as a source of vitamin A, thus suggesting that the formation of large amounts of vitamin A in green leaves requires the influence of light.

Evidence is also furnished in this contribution that vitamin A can be produced from the green plant from inorganic sources as shown by its high content in the green shoots of *Tradescantia* (wandering jew) grown in water, that green cabbage is much richer in vitamin A than white cabbage, that mushrooms contain only a small amount of vitamin A, and that common green seaweeds (*Ulva* and *Cladophora*) are as potent in vitamin A as the green land plant such as cabbage, while red seaweed (*Polysiphonia*) and carrageen moss (*Chondrus crispus*) have no appreciable amounts of vitamin. All these observations point to the greater activity with respect to vitamin A of chlorophyll-containing plants.

Protein extracts of green spinach prepared by the method of Chibnall and Schryver (E. S. R., 44, p. 504) showed no greater activity than could be accounted for by absorption of a slight amount of vitamin, thus indicating that vitamin A is not present in the form of a complex with protein in green leaves unless the method of preparation resulted in the resolution of such a complex.

The earlier conclusion of Drummond that vitamin A is destroyed by saponification at room temperature (E. S. R., 41, p. 559) has been found untenable. If oxidation is prevented, it has been found possible to prepare a highly concentrated fraction by cold or hot saponification of animal oils or plant tissues.

Researches on vitamin A.—VII, Notes on the factors influencing the value of milk and butter as sources of vitamin A, J. C. DRUMMOND, K. H. COWARD, and A. F. WATSON (*Biochem. Jour.*, 15 (1921), No. 4, pp. 540–552, figs. 3).—This paper, continuing the series of studies previously noted (E. S. R., 45, p. 564), summarizes the results of an extensive series of observations and studies of the vitamin A content of milk and butter under varying conditions.

The feed of the cow is considered to be the chief cause of variation in the amount of vitamin A in milk, the apparent seasonal variation being due to the different character of the diet ordinarily consumed at different seasons. While no definite conclusion has been reached regarding the effect of breed, the impression gained has been that milk obtained from cows of the Jersey and closely related breeds has a tendency to be richer in vitamin A than that yielded by Shorthorns and Angus. As a possible explanation it is suggested

that cows of the former breeds may have a higher storage capacity for vitamin A similar to their higher capacity for storing pigments, or that the higher vitamin content may be connected with the high fat content of these milks.

Results are reported showing that colostrum has a much higher concentration of vitamin A than the later milk. "We are inclined to regard this higher value of colostrum as an indication of a mobilization of the reserves of the mother since it does not appear to be proportional to the fat content. . . . It is again interesting to recall that there is also a partial mobilization of the lipochrome pigments of the mother's body fat for the production of colostrum, which normally contains a much higher concentration of these coloring substances than the fat of the later milk."

Three factors influencing the vitamin A content of butter are discussed: (1) The influence of the process of manufacture, (2) the original vitamin content of the milk as influenced by the factors discussed above, and (3) the storage and preservation of the butter. Butter is shown to be less potent as a source of vitamin A than the same amount of fat supplied in the original milk. Growth curves of rats receiving, respectively, as the source of vitamin A 2 cc. of milk, separated milk, and buttermilk, and the equivalent amount of butter made from the milk, showed a decreasing content of vitamin A in the order of original milk, butter, separated milk, and buttermilk. The authors are inclined to attribute the lower potency of the butter as compared with the original milk rather more to the destruction of the vitamin in the process of butter making than to the distribution of the vitamin in the aqueous and nonaqueous phases of the milk.

The observations on the vitamin A content of various samples of butter confirm previous observations on the low vitamin content of butter produced in winter months from cattle fed in the stall on dry feeds, and show that even the drying of pasturage in a hot summer may appreciably lower the value of the butter as a source of vitamin A.

Examination of storage butter has shown that the season at which the butter was placed in the storage, i. e., the diet of the cows at that season, is a more important factor in determining the value of the storage butter than the length of time the butter remains in storage, provided undue exposure of surface to air is prevented and other conditions of storage are good.

Destruction of vitamin A was found to occur during the processes of rancidity if oxidation is involved, but a considerable development of free acid may occur without loss of vitamin A if oxidation is prevented. It is pointed out that the renovation of rancid butter will entail further loss of vitamin A if the methods employed are such as to cause oxidation.

A contribution to the study of the relation between vitamin B and the nutrition of the dog, G. R. COWGILL (*Amer. Jour. Physiol.*, 57 (1921), No. 3, pp. 420-436, figs. 13).—The data presented in this paper constitute an amplification of the results reported by Karr in a similar study (*E. S. R.*, 44, p. 860), the methods employed being essentially the same. Dried brewery yeast, neutralized tomato juice, and alcoholic extracts of wheat embryo, of rice polishings, and of navy beans were employed as sources of vitamin B.

All these materials showed pronounced curative effects when fed to polyneuritic pigeons, and all were found capable of restoring the desire for food in a dog which had lost appetite through being confined to a diet lacking vitamin B. Dogs on diets adequate in other respects but lacking vitamin B usually show loss of appetite in from 5 to 15 days, and thereafter eat very irregularly if at all. If the dog continued to eat some food it eventually showed symptoms of polyneuritis, differing somewhat in appearance from

those exhibited by pigeons and fowls. Paralysis of the hind legs, resulting first in a peculiar dragging of the feet and then a complete loss of the control of the hind limbs, was the most characteristic feature in the dog. Often the first signs of paralysis were accompanied by vomiting and a noticeably foul breath. Convulsions usually began not long after the appearance of the paralysis. If, however, vitamin B in the form of the above extracts was given after paralysis had appeared, the symptoms of polyneuritis promptly disappeared.

The antiscorbutic and antiberiberi properties of certain sun-dried vegetables, J. A. SHORTEN and C. B. ROY (*Biochem. Jour.*, 15 (1921), No. 2, pp. 274-285, figs. 7).—In continuation of the study previously noted (E. S. R., 43, p. 63), nine varieties of sun-dried vegetables were tested for antiscorbutic properties and six for antineuritic properties by the method employed in the previous study, the daily ration of the vegetables being 5 gm. in the antiscorbutic and 10 gm. in the antineuritic tests.

Sun-dried tomatoes, potatoes, and cabbage were found to retain to a considerable extent their antiscorbutic properties, while sun-dried carrots, bringal (eggplant), spinach, turnips, turnip tops, and mixed factory-dried vegetables had little or no antiscorbutic effect. None of the cooked vegetables showed any antiscorbutic properties. The vegetables tested for antineuritic properties (carrots, bringal, spinach, cabbage, tomatoes, and potatoes), all gave ample protection against polyneuritis to common fowls weighing on the average 1,600 gm.

The antiscorbutic principle in potato juice extracted in the presence of acids, BEZSSONOFF (*Compt. Rend. Acad. Sci. [Paris]*, 173 (1921), No. 8, pp. 417-419).—It is suggested that the loss of antiscorbutic properties in potato juice prepared as previously noted (E. S. R., 45, p. 568) is due in large measure to enzym action, particularly of the oxidase laccase. In confirmation of this it is reported that the extracted juice of potatoes ground before pressing with a mixture of 1 part of citric or tartaric acid and 4 parts of sucrose to 500 parts of potato proved superior to potato juice prepared without this addition. The acid is considered to have paralyzed the action of the laccase present in the potato. In connection with this experiment it is also noted that new potatoes are richer in antiscorbutic properties than old.

The antiscorbutic property of some desiccated fruit juices, M. H. GIVENS and I. G. MACY (*Jour. Biol. Chem.*, 46 (1921), No. 1, *Proc.*, pp. XI, XII).—A brief report without experimental data is given of an investigation of the antiscorbutic properties of various fruit juices dehydrated by a commercial process. The products obtained from the juices of lemons, tomatoes, grapefruit, and oranges were found to possess a significant amount of antiscorbutic vitamin, while dehydrated grape juice and raspberry juice showed no antiscorbutic properties. The products, with the exception of the lemon juice, were from 14 to 20 months old at the time of testing.

Calorimetric investigations on inanition and deficiency disease.—I, On inanition. II, On deficiency disease, P. NOVARO (*Pathologica*, 12 (1920), Nos. 275, pp. 87-100, figs. 3; 277, pp. 133-156, figs. 11; *abs. in Med. Sci., Abs. and Rev.*, 3 (1921), No. 4, pp. 371, 372).—These two papers present the results of a comparative study of changes in body weight, temperature, and energy liberated (as determined by a D'Arsonval calorimeter) in pigeons subjected to inanition and to a polished rice diet.

In pigeons receiving no food the loss in body weight was in direct relation to the amount of heat given off and to the length of the starvation period. The amount of heat given off increased rapidly just before death. In pigeons kept on a diet of polished rice the weight, body temperature, and amount of

heat given off showed no alteration during the first period of from 7 to 13 days. After this the quantity of food taken, amount of heat given off, and the body weight decreased, while the temperature remained practically the same for a considerable period, after which there was a remarkable lowering of body temperature without a corresponding increase in the amount of heat given off. This is thought to indicate that in deficiency disease the mechanism of heat production must be affected. After the administration of vitamin extracts there was an increase in the amount of heat given off and in the body temperature.

The nervous lesion of beriberi and its bearing on the nature and cause of the disease, F. M. R. W[ALSHE] (*Med. Sci., Abs. and Rev.*, 2 (1920), No. 1, pp. 41-46).—The author reviews the literature on the pathology and symptomatology of beriberi and discusses its bearing on the current hypotheses as to the origin of the disease. It is pointed out that until metabolism in beriberi has been more thoroughly investigated the exact pathogenesis of the disease can not be understood. Stress is laid, however, on the conclusion of Eijkman, that even though we hold the vitamin starvation theory the ultimate cause of beriberi may yet prove to be a nerve poison produced by a disordered metabolism arising from vitamin deprivation.

The etiology of rickets: An experimental investigation, D. N. PATON and A. WATSON (*Brit. Jour. Expt. Path.*, 2 (1921), No. 2, pp. 75-94, pls. 2, figs. 9).—Evidence is furnished in this paper that rickets is not caused solely by the absence from the diet of an antirachitic factor associated with milk fat. A diet of oatmeal and milk furnishing not less than from 3 to 7.6 gm. of milk fat per kilogram of body weight did not prevent the onset of rickets in puppies kept in the laboratory. The animals with the lowest energy intake became the most markedly rachitic, suggesting that a sufficient energy intake may decrease susceptibility to the disease apart from the influence of any accessory factor. Puppies kept largely in the open air escaped the development of rickets on an intake of less than 1 gm. of milk fat per kilogram of body weight, and it was even possible to raise puppies free of rickets in the laboratory on an intake of only about 0.5 gm. of milk fat per kilogram along with bread, provided that the diet afforded an adequate supply of energy.

Scurvy.—The effect of heat on vitamins. A contribution to the question of food concentration, E. NOBEL (*Ztschr. Kinderheilk., Orig.*, 28 (1921), No. 5-6, pp. 348-370, figs. 10).—The author reports that seven children at the University Children's Hospital of Vienna were cured of scurvy on a diet consisting principally of milk which had been boiled for varying periods of time—in five cases for from 10 to 35 minutes and in two for 1 hour. It is concluded that the antiscorbutic vitamin is not so heat-labile as has previously been reported.

Scurvy: A system of prevention for a polar expedition, based on present-day knowledge, A. H. MACKLIN and L. D. A. HUSSEY (*Lancet [London]*, 1921, II, No. 7, pp. 322-326).—Following a brief discussion of the literature on scurvy and the antiscorbutic vitamin, the authors outline the means taken in the Shackleton polar expeditions to prevent scurvy. The antiscorbutic substances used on board ship include lemon juice concentrated by the method of Bassett-Smith (*E. S. R.*, 44, p. 361) but not made into tablets, dried milk prepared by the roller process from milk of healthy cows fed on good pasturage, condensed milk, canned tomatoes, potatoes, carrots, and onions, and as an emergency measure peas, beans, and lentils for sprouting. For sledging conditions reliance is placed on lemon juice tablets and dried milk packed in small air-tight containers, each package containing only one day's ration.

The prevention of beriberi is aimed at by provision of unpolished rice, whole meal flour, dried eggs, dried peas, beans, lentils, and fresh meat where possible. Marmite is added to the sledging ration, and fresh penguin eggs are used when obtainable.

Are eating utensils carriers of tubercle bacilli? H. L. TAYLOR (*Amer. Rev. Tuberculosis*, 5 (1921), No. 4, pp. 351-355).—In order to determine whether eating utensils as ordinarily washed in public and private tuberculosis sanitariums carry living tubercle bacilli, experiments were conducted at three different institutions. In two of these dish washing machines with hot water and steam were used, while in the third the dishes were washed in hot water in dishpans in the diet kitchens.

Of 30 guinea pigs inoculated with sterile salt solution containing the swabbings from spoons used by tuberculosis patients 4 contracted tuberculosis, all from swabbings of unwashed spoons. No animal developed tuberculosis following injections with the swabbings of washed spoons. These results are thought to indicate that tubercle bacilli are present on eating utensils used by tuberculosis patients, and that care should be taken in the proper disinfection of all eating and drinking utensils.

Observations on *Bacillus botulinus* infection of canned spinach, S. A. KOSER, R. B. EDMONDSON, and L. T. GILTNER (*Jour. Amer. Med. Assoc.*, 77 (1921), No. 16, pp. 1250-1253).—This paper, from the Bureaus of Chemistry and Animal Industry, U. S. Department of Agriculture, presents results obtained in the experimental inoculation of canned spinach with *B. botulinus* and in the examination for *B. botulinus* of miscellaneous samples of canned spinach collected following recent outbreaks of botulism traceable to canned spinach, reported by Geiger (*E. S. R.*, 45, p. 369).

The results obtained show that *B. botulinus*, type A, is able to multiply and produce its toxin in canned spinach, although the development of the organism was found to be somewhat irregular. The growth of the organism in canned spinach is accompanied by the evolution of gas as well as by the formation of the specific toxin. In only one instance was there toxin formation without sufficient gas production to cause bulging of the can.

Of 174 samples of canned spinach taken from suspected lots, *B. botulinus*, type A, or its toxin was found in 6. These cans were all "hard swells" and gave a distinctly offensive odor when opened. "The destruction of foodstuffs deemed to be abnormal, either by appearance of the containers or by the odor, should prevent the greatest number of the outbreaks of botulism. From the public health aspect of the problem, the last point is of especial importance."

The precipitation of botulinus toxin with alcohol, J. BRONFENBRENNER and M. J. SCHLESINGER (*Soc. Expt. Biol. and Med. Proc.*, 18 (1921), No. 8, pp. 304, 305).—Following the observation that in several outbreaks of botulism those who had partaken of alcoholic beverages were not severely affected by the toxin-containing food, it has been demonstrated that ethyl alcohol even in weak solution (20 to 30 per cent) is capable of destroying botulinus toxin in vitro, the time required being only from 5 to 10 minutes if the temperature is kept at 37° C. Further experiments with guinea pigs have shown that 6 cc. of 30 per cent alcohol administered per os immediately following similar administration of sufficient botulinus toxin to kill within 24 to 48 hours has sufficed to protect the animals, while controls receiving only the toxin died in the usual time. That the alcohol destroys the toxin by direct action has been shown by the death of guinea pigs following the ingestion of botulinus toxin if the alcohol is administered subcutaneously, or if the toxin is given intraperitoneally and the alcohol administered by mouth.

ANIMAL PRODUCTION.

The effect on growth of breeding immature animals, F. B. MUMFORD (*Missouri Sta. Research Bul. 45 (1921), pp. 3-37, pls. 6*).—This bulletin, limited to a study of the influences affecting the immature sow, presents in tabular and graphic form the data secured in investigations of the effect of the gestation period and of the lactation period on the growth of the young sow. A study was made also of the comparative amounts of feed consumed by sows during periods of pregnancy and lactation.

The averages of gain in weight determined for 11 pregnant sows during the period of gestation as compared with those of an equal number of nonpregnant sows for the same period of time seemed to indicate that pregnant sows gained considerably more in weight than nonpregnant. As shown by the averages of body measurements, the growth in the two groups was not essentially different. The records kept through a period of several years gave no evidence that the period of pregnancy or gestation has a retarding effect upon the growth of the young sow.

Similar data secured for seven sows during their first lactation period and an equal number of immature nonpregnant and nonlactating sows showed that little or no growth is made by the lactating female. The sows were kept under optimum condition of feed and care. In two cases the lactating animals lost weight rapidly during the early stages of the lactation period and practically regained all this loss before the pigs were weaned. The greatest loss in weight during the lactation period invariably occurred during the first month. It is concluded that immature sows bred at 5 months of age and twice a year thereafter may be expected to develop into somewhat smaller animals at maturity than would be the case if they were not bred until more nearly mature.

The immature bred sows in the experiment matured at the average age of about 39 months, the range being from 30 to 47 months, while sows not bred until 24 months old matured 10 to 12 months earlier. This later development of the immature bred sows is attributed on the basis of the data to the retarding effect of the period of lactation. The difference in size at maturity between animals bred at a very young age and those bred at a later age is not regarded as significant.

On the average the sows suckling pigs lost 16.5 lbs. during the lactation period, while the dry sows during the same period of time gained an average of 25.8 lbs. The lactating sows consumed on the average 1,280 lbs. of digestible nutrients per 1,000 lbs. of live weight, while pregnant sows during the same period received on the average only 798 lbs. of digestible nutrients per 1,000 lbs. of live weight. The pregnant sows showed a difference in increased live weight over the lactating sows of 42 lbs. per head. The record of the investigation seems to indicate that the greatest loss in weight occurred during the first lactation period, and that when the young sow is suckling a large litter of pigs growth is inhibited.

[Report of work at the Iowa Station in animal husbandry] (*Iowa Sta. Rpt. 1920, pp. 19-27, 29-31, 60, 61, 62*).—Different lines of work are briefly reviewed, and reports of progress are made.

The results of feeding experiments indicated that, fed with a standard corn belt ration, cane molasses is more valuable for cattle than beet molasses, but that the economical margin in the use of molasses generally is rather narrow.

Experiments to determine the effects of adding substances carrying vitamins in abundance to the rations of pigs consisting of mixed shelled corn, meat meal tankage, and salt, self fed, showed that orphan pigs, receiving in addi-

tion a quart of whole milk with 5 oz. of tomato juice per head daily for the first 60 days averaged 80 lbs. at 90 days of age, or 25 lbs. more than pigs fed only milk in addition. This result represented an increase of 45 per cent in final weight due to tomato juice as compared with 44 per cent for pigs receiving the juice of one orange and with 41 per cent for those receiving one egg a day instead of the tomato juice.

In other experiments with pigs it was found that the results secured with specially mixed feeds in addition to rape pasture did not encourage their substitution for corn in a properly balanced ration. Sudan grass pasture appeared to be relatively less valuable as a developing than as a carrying or maintenance feed.

During a period of three years at the station, the small type of pig was clearly excelled by the big or large type. When the pigs of the smaller type weighed about 225 lbs. they were extremely fat, their consumptive ability decreased to a marked extent, and they exhibited a tendency to suffer from asphyxiation. For fattening pigs oats did not prove an especially valuable feed, and corn gluten feed for fall pigs gave unsatisfactory results.

The feeding of acid rations indicated that swine can consume relatively large quantities of acid without injurious effects. Some brood sows receiving as much as 250 cc. of normal sulphuric acid per day farrowed and raised their litters successfully. Results of preliminary work indicated that swine require a certain minimum of the fat-soluble vitamin.

Feeding experiments with poultry indicated the value of classifying spring chickens according to weight and vitality for crate feeding, as birds of low vitality made economical gains in batteries by themselves. In feeding different breeds for egg production the most economical ration consisted of a scratch feed of shelled corn and oats (2:1), and of a mash feed of ground corn, ground oats, and 60 per cent protein tankage (1:2:1). During the winter from 15 to 25 per cent by weight of tankage was found desirable, and while this could be reduced to 10 per cent in the summer with little loss in egg production, the cheapest eggs were produced with the use of from 15 to 20 per cent of tankage the entire year. A high producing Rhode Island Red hen, with a total production of 831 eggs at the close of her fourth laying year, is described, and it is stated that the work of breeding for egg production shows that the high-producing birds may be selected toward the close of the first laying year.

[Report on work in animal husbandry at the Missouri Station], E. A. TROWBRIDGE ET AL. (*Missouri Sta. Bul.* 189 (1921), pp. 20-29, figs. 5).—Some results obtained, together with the progress made in certain lines of study conducted by different investigators, are briefly reported.

Sunflower seed as a feed for fattening swine, L. A. Weaver (pp. 22, 23).—A feeding test with six lots of hogs was conducted for 98 days to compare sunflower seed and corn as fattening feeds. Sunflower seed and corn were each fed alone and in combinations of 3:1, 1:1, and 1:3, while one lot received 10 parts of corn and 1 part of tankage. Corn fed alone proved a better feed than sunflower seed fed alone. The best results were secured with equal parts of corn and sunflower seed, and these compared favorably with the ration of corn and tankage.

Growing draft colts, E. A. Trowbridge and D. W. Chittenden (pp. 26, 27).—Seven head of yearling draft colts fed during their second winter for 130 days with an average daily ration of 10.83 lbs. of grain, consisting of 2 parts of corn, 2 parts oats, and 1 part bran, and 13.99 lbs. of alfalfa hay, made an average daily gain of 1 lb. each.

Heavy and light grain rations when fed in connection with corn silage and clover hay for fattening steers, E. A. Trowbridge and H. D. Fox (p. 28).—The sixth trial, which is here reported, was conducted as in previous years (E. S. R., 45, p. 268). The results differed from those of the earlier tests in that the lot fed a full feed of shelled corn and linseed oil cake (6:1) for the entire period made the most economical gains. It is pointed out that this is due to the low price of concentrates as compared to the very high price during the time the earlier tests were made.

Hogging down corn and soy beans, L. A. Weaver (pp. 28, 29).—Work previously reported (E. S. R., 45, p. 271) was repeated in 1920. The results differ from those in 1919 in that more pork was secured from the corn plat than from the corn and soy bean plat. Otherwise the data substantiated earlier results that either corn alone or corn and soy beans may be satisfactorily hogged down; self-fed tankage to hogs on corn materially increases the rate and economy of gain; soy beans are not a complete substitute for tankage; and that an acre of corn pastured off with hogs fed tankage in addition will produce more pork than can be secured from an acre of corn and soy beans pastured off without such supplement.

[*Work of the Montana animal husbandry department*], C. N. ARNETT and D. HANSEN (*Montana Sta. Rpt. 1920, pp. 22-24, 40, 41, 42*).—A progress report on the animal husbandry work of the station is made, and some of the results are briefly noted.

In work at the main station, by C. N. Arnett, mature beef cows maintained their weight and condition throughout the winter on 18 lbs. of one part timothy and two parts alfalfa hay per head per day, but similar cows fed either 1½ lbs. of oil meal with all the straw they would eat or 1 lb. of oil meal with 12 lbs. of hay each daily, failed to keep in strong condition. The results of feeding beef calves either on alfalfa hay, on equal parts of alfalfa hay and sunflower silage, or on the hay and silage with 3 lbs. of grain per head daily, showed that each of these rations was adequate for growing beef calves.

An experiment in feeding breeding ewes for 62 days indicated that oil cake used to replace about one-fourth of the hay ration had approximately 5.5 times the feeding value of alfalfa hay, while of the sunflower silage used in a similar manner 2.57 lbs. were required to replace 1 lb. of hay in this test. Feeding ewes on sunflower silage alone proved successful only for a limited period.

For pasturing swine, alfalfa ranked first, medium red clover second, and rape third. A comparison of feeding barley and barley and tankage to swine on alfalfa pasture or in the dry lot showed that where barley only was fed the pigs on alfalfa pasture had a slight advantage over those fed in the dry lot, but when the barley was supplemented with tankage and both fed by the free choice system there was little difference in the results from the pasture and dry lot feeding when the value of the alfalfa was considered.

In work at the Huntley Substation, D. Hansen reports that a pasture seeded in 1916 with a mixture of awnless brome grass, orchard grass, tall fescue, perennial rye grass, Kentucky blue grass, and white and alsike clover had a carrying capacity of 1.9 cows per acre during a grazing season of about 4½ months. The average results of 10 years of pasturing hogs on corn showed that 445 lbs. of corn were required to produce 100 lbs. of gain as compared with 386 lbs. of corn when rape was drilled between the rows. There was little difference in the amount of grain required to produce a finished hog by using a self-feeder or by feeding a limited ration while on pasture. Adding tankage

to a corn ration for hogs on alfalfa pasture slightly reduced the feed necessary to produce 100 lbs. of gain. As compared with tankage and mill feed, skim milk was found the most satisfactory protein supplement to corn for finishing hogs in the dry lot.

[**Work in animal husbandry at the New Mexico Station**] (*New Mexico Sta. Rpt. 1920, pp. 44-52, figs. 3*).—The progress and future plans of lines of work are discussed, and some of the results are reported. An experiment on the maintenance of range cows on chamiza brush reviewed here has been noted previously (E. S. R., 45, p. 573).

In a lamb feeding test of 89 days comparing cull Pinto beans with corn, alfalfa hay being used as the roughage, 1,215 lbs. of hay and 301 lbs. of corn were required by one lot of 10 lambs, and 1,416 lbs. of hay and 344 lbs. of the cull beans by another lot to produce 100 lbs. of gain. A third lot fed tornillo beans required 2,275 lbs. of hay and 456 lbs. of beans for a similar gain.

The results of feeding two lots of shotes for 93 days, one with ground corn and the other with equal parts of ground corn and tornillo beans, indicated that 100 lbs. of corn is equal in feeding value to 162 lbs. of tornillo beans.

In an experiment begun 2 years previously on the maintenance of range cows, five grade Hereford heifers were left on the range during the winter while a similar lot was kept on an inclosed native pasture and given silage and roughage for full maintenance. The weights of the animals and of the calves they produced were determined at different times. The calves of the range cows weighed less at birth than those of the fed cows, but when they were a year old there was not so much difference in their weights as was indicated by their weights at birth or at weaning time.

[**Work in animal husbandry at the Texas Station**] (*Texas Sta. Rpt. 1920, pp. 16-18, 57, 58, 62, figs. 2*).—It is stated that the results of experiments with laying hens showed that cottonseed meal can be substituted for meat scrap or tankage to the extent of 45 per cent of cottonseed meal in the ration. Observations on the keeping quality of eggs indicated that nonfertile eggs³ will remain in good condition for 15 days during ordinary Texas summer conditions.

Experiments in fattening lambs, to compare the value of milo, feterita, kafir, and corn, have showed conclusively, it is stated, that the grain sorghums can be used more profitably than corn for fattening lambs in western Texas. Straight Rambouillet and cross-bred lambs on a fattening ration made about equal gains, which is considered as making the straight Rambouillet lambs, being smooth-bodied and possessing the superior adaptability of the fine-wool sheep to range conditions, the more desirable of the two types for Texas ranches.

A swine feeding experiment indicated that grazing hogs on peanuts for 6 weeks preliminary to the fattening period does not influence materially the hardness of the fat, and showed further that feeding equal parts of rice bran and corn chop with 10 per cent of tankage will not cause the carcasses to be graded as soft. A mixture of 10 parts of rice bran and 1 part of cottonseed meal fed to hogs for 80 days resulted in soft pork in half the number of hogs fed. Other hogs fed this same ration with one-half the rice bran replaced with milo chop made better gains and all hogs killed firm.

A graphical presentation of the financial phases of feeding experiments, H. H. MITCHELL (*Illinois Sta. Bul. 234 (1921), pp. 271-327, pl. 1, figs. 15*).—This bulletin discusses the problem of giving a proper financial interpretation to experimental feeding data, and presents and illustrates graphical methods for use in this connection in place of complicated arithmetical calculations. The financial aspect of a feeding operation is considered as resolving itself into

the difference between the selling price of the animal and its original cost and the expenditures involved in fattening. It is pointed out that the financial presentation of the results of feeding experiments should be such as to aid in calculating or approximating the feed bill per head, the necessary margin to cover expenditures, and the probable profit per animal. The charts proposed for use in these calculations include those with two, three, and more than three variable factors, together with one permitting greater flexibility in financial predictions.

Based on the results of experiments in milk production and in feeding steers, sheep, and swine at different experiment stations, the charts are designed for the calculation of net receipts per head, expenditure for feed, cost of gain per hundredweight, cost of gains at different weights, total feed bill per head at varying prices, average cost of milk per hundredweight per year on the basis of the herd and of the cow, average monthly cost of milk per hundredweight from average yearly cost, feed bill and necessary margin of steer fattening operation, necessary margin of steer feeding operation for varying cost of feeders, gain secured, feed cost, and final weight of steers, and the calculation of profit or loss per head in steer feeding operations from the final weight of the steer and the difference between the actual and necessary margins. The application of the charts to the problems is explained and suggestions are given for increasing the precision of financial estimates.

Cost of beef production in Iowa (*Iowa Sta. Rpt. 1920, pp. 43, 44*).—Financial results of feeding are tabulated, the data having been derived from a survey study on 81 droves, including 3,996 cattle in Pottawattamie County, Iowa, in the fall of 1919, and one of 87 droves, including 3,165 cattle, made in the spring of 1920. Figures are included also which were collected by visits to 20 farms, securing detailed costs on 26 droves, including 1,129 cattle.

Cattle feeding investigations, 1920-21, C. W. McCAMPBELL and H. B. WINCHESTER (*Kansas Sta. Circ. 92 (1921), pp. 13, figs. 3*).—This circular briefly sets forth the results of five different feeding tests.

An experiment to determine the maximum economical utilization of silage in fattening baby beef, in progress for 207 days, involved the feeding of heavy silage and light grain and light silage and heavy grain rations. Lots 3, 4, 5 and 6, of 10 steers each, consumed an average daily ration of 11.19, 20.47, 17.75, and 13.56 lbs. of cane silage per head, respectively. All lots received about 1.75 lbs. cottonseed meal, approximately 0.05 lb. of salt, and all excepting lot 6 about 2 lbs. of alfalfa hay per head per day. The different lots consumed daily 8.97, 4, 3.84, and 8.54 lbs. of shelled corn per head, respectively, and lot 5 consumed also 1.77 lbs. of blackstrap molasses per head daily. Lots 3 and 4 received no corn during the first 120 days of the experiment.

The sale of the cattle without profit or loss, based on farm prices, would have paid a gross income of \$52.50 per acre for cane silage and \$26 per acre for shelled corn. The feeding of 2 lbs. of alfalfa hay, as shown by the results from lots 3 and 5, increased the daily gains by 0.29 lb., reduced the cost of gains 55 cts. per 100 lbs., and added 50 cts. per 100 lbs. to the selling price. The addition of the blackstrap molasses to the ration increased the gains slightly and improved the general appearance of lot 5, but it increased the cost of gains \$1.33 per 100 lbs. and apparently reduced the selling price by 25 cts. per 100 lbs. as compared with lot 4.

Plain mature steers and quality mature steers were fattened for 178 days on cane silage, alfalfa hay, cottonseed meal, and shelled corn. The plain cattle were big, rough, coarse, plain-headed, 3- and 4-year-old Texas steers uneven in size and conformation, while the quality cattle were smooth, good-headed, well-

made, 3-year-old steers even in size and conformation. The daily gains were practically the same for the two lots, but the quality steers required slightly less feed per 100 lbs. of gain and dressed slightly higher. However, they brought only 50 cts. more per hundred, while the difference in market price at the beginning of the test was \$2 per hundred.

A comparison of silage and alfalfa hay for wintering steers indicated that yearling steers wintered on silage made very satisfactory gains on grass the following summer.

Different kinds of corn silage were compared in a test with steers to determine their relative feeding value. The kinds of silage used were made from corn when the grain was in the dent stage, from corn allowed to stand six weeks after it had reached the dent stage, and from corn of this later stage of maturity but with the ears removed. The corn cut in the dent stage produced 9.47 tons of silage per acre containing 2.89 tons of dry matter, while the mature corn produced only 4.47 tons of silage with 1.88 tons of dry matter. The silage from an acre of corn cut in the dent stage produced 729.51 lbs. of gain as compared with 439.72 lbs. for the silage from the mature corn. In this test a ton of dry matter in the silage from the mature corn, including the grain, had approximately four times the feeding value of the silage made from the mature corn with the ears removed, which yielded only 3 tons of silage per acre with 1.03 tons of dry matter.

The results of a test with yearling steers to compare the feeding value of corn in silage with the corresponding quantity of shelled corn indicated that the grain in mature corn silage had a greater feeding value pound for pound than did shelled corn, the increase in this experiment amounting to 12 per cent.

The trail of the short grass steer.—The story of a Great Plains grazing trial, J. H. SHEPPERD (*North Dakota Sta. Bul. 154* (1921), pp. 8, figs. 9).—The results of observations made to determine the daily distance traveled by cattle on prairie pasture indicated that this distance is in direct ratio to the size of the pasture. On a 30-acre pasture with fair grazing the cattle walked 1.62 miles, on a 100-acre pasture with good grazing they walked 3.06 miles, and on a 640-acre pasture, on which the grazing was a little scant, a herd of dairy cattle traveled 5.5 miles per day. During the period from 10.30 a. m. to 8.30 p. m. these range cattle were observed to be inactive from $\frac{1}{2}$ to $3\frac{1}{2}$ hours, according to the natural thrift of the individual animals.

A comparison of broken ear corn and shelled corn, fed with silage, for fattening steers, E. S. GOOD and L. J. HORLACHER (*Kentucky Sta. Circ. 26* (1921), pp. 15-26, figs. 2).—Corn was fed during the last 80 days of a 140-day steer feeding experiment begun December 8, 1920, with two lots of 10 steers each. The lot fed broken ear corn consumed 3.76 lbs. of corn (on a shelled basis), 1.83 lbs. of cottonseed meal, and 17.8 lbs. of silage per pound of gain and made an average daily gain of 1.89 lbs. per head. The check lot fed shelled corn consumed 2.96 lbs. of corn, 1.77 lbs. of cottonseed meal, and 18.1 lbs. of silage per pound of gain and gained at the rate of 1.95 lbs. daily. In this experiment shelling the corn was unprofitable.

Sunflower silage (*New Hampshire Sta. Bul. 198* (1921), pp. 15, 16).—Tests of sunflowers for silage in 1919 and 1920 are briefly reported. The sunflowers excelled corn in withstanding drought and frost. While cattle preferred corn silage, a mixture of corn silage and sunflower silage (2:1) seemed to make a good combination. When planted thickly to reduce the thickness of the stalks sunflowers broke over, making harvesting difficult. The chemical composition of this silage is given as follows: Water 81.3 per cent, protein 1.7, fat 0.8, ash 1.6, crude fiber 5.8, and nitrogen free extract 8.8 per cent.

Fertility in Shropshire sheep, E. ROBERTS (*Jour. Agr. Research* [U. S.], 22 (1921), No. 4, pp. 231-234).—Studies made at the Illinois Experiment Station are reported.

A classification based on the age of the dams of 9,868 lambs, recorded in the 1912 volume of the American Shropshire Sheep Record, showed 60.8 per cent were single lambs, 38.7 per cent were twins, and 0.6 per cent triplets. A classification of the dams on the basis of their age showed that the percentage of multiple births increased with the age of dams until the fifth or sixth year and thereafter remained fairly constant at about 40 per cent until the eighth year. Other data secured failed to indicate that the age of the ram had any influence on the percentage of multiple births. Among Shropshire sheep more multiple births were found to occur early in the lambing season than late. A similar study made of the Dorset breed, which produces a large number of lambs in the fall, showed that the larger number of multiple births occurred in the spring.

Amount of grain to feed spring pigs on forage, W. L. ROBISON (*Ohio Sta. Mo. Bul.*, 6 (1921), No. 7-8, pp. 120-128, fig. 1).—The average results of a number of experiments with spring pigs on forage are given in tables and are discussed from the standpoint of the value of full and limited feeding, the effect of the grain fed on the consumption of forage, and the economic conditions as affecting the feeding of spring pigs. The tests were begun shortly after weaning time when the pigs averaged 40 lbs. in weight and were continued for 130 days, during which the pigs were on pasture and different lots were fed various quantities of concentrates, consisting generally of corn and tankage. Similar work has been noted (E. S. R., 44, pp. 471, 772).

The principal results are summarized in the following table:

Results from feeding concentrates to pigs on forage.

Quantities fed daily.	Average daily gain.	Concentrates.			Gain per head.	Final weight.
		Daily per pig.	Daily per 100 lbs. live weight.	Per 100 lbs. gain.		
	Pounds.	Pounds.	Pounds.	Pounds.	Pounds.	Pounds.
1.4 per cent of live weight.....	0.42	0.94	1.40	225.38	54.5	94.5
2.3 per cent of live weight.....	.70	2.03	2.34	291.23	90.7	130.7
2.9 per cent of live weight.....	.96	3.00	2.90	312.73	124.8	164.8
Limited feed first; full feed later.....	1.14	3.69	3.19	325.23	147.6	187.6
Full feed entire time; hand fed.....	1.29	4.65	3.63	361.71	167.2	207.2
Full feed entire time; self fed.....	1.50	5.51	4.18	367.98	194.6	234.6

The self-fed lot was fed only until an average weight of 208 lbs. was reached. The rate of gain depended directly on the intensity of feeding. The self-fed pigs consumed more concentrates and gained more rapidly than similar hand-fed pigs. While greater intensity in feeding increased the rapidity in gains, a smaller gain was produced from a given amount of concentrates as the grain fed was increased.

Based on these and other results a table also is given comparing the various amounts of concentrates needed to have brought the pigs to a weight of approximately 210 lbs. This is based further on the assumption that the average results of a number of dry-lot experiments from the time the weights of the pigs used approximated those of the limited-fed pigs at the close of the grazing period until they reached approximately 210 lbs. in weight would be similar to those likely to be obtained from finishing light-fed pigs in the dry lot after the grazing season. Data are compiled also to show the effect of the amount

of concentrates fed in connection with forage on the percentages of old and new corn required to bring the pigs to 210 lbs.

It is concluded that limited feeding lowers the concentrate requirements per unit of gain while the pigs are on forage, permits a maximum use of corn, and makes it possible to convert the new crop into cash more quickly than can be done in any other way when it is fed to hogs. It is pointed out, however, that when pigs are full fed their growth is more rapid, which tends to reduce the labor, interest, overhead expense, the risk from disease, and the pasture charge. It is also pointed out that the full-fed pigs may be marketed earlier at a time when prices are generally more favorable.

Feeding purebred draft fillies, J. L. EDMONDS and W. G. KAMMLADE (*Illinois Sta. Bul. 235, pp. 329-360, figs. 8*).—The experiments here reported are in continuation of those previously noted (*E. S. R., 36, p. 569*). The object of the work here described, designated as the second and third experiments, was to find a ration even more satisfactory for producing high-class fillies than the ration of corn, oats, and alfalfa used in the first experiment. In each of the second and third trials, 16 Percheron weanling fillies, divided into two equal lots, were used. The fillies were pastured on heavy blue grass with a mixture of timothy, orchard grass, medium red clover, and white clover for 160 and 165 days for the second and third experiments, respectively. An acre of pasture was allowed per head. Those in the second experiment received, as roughage, alfalfa hay and oat straw, and those in the third were given alfalfa hay the first winter and alfalfa hay supplemented with oat hay the second winter. The second experiment lasted a total of 518 days, and the third experiment of 490 days. The general results are summarized in the following table:

Comparison of grain rations for Percheron fillies.

Feeding periods.	Lots.	Grain mixtures fed.	Average grain ration.	Average weight.		Daily gain per head.	Average gain in height.	Feed per pound of gain.		
				Initial.	Final.			Grain.	Alfalfa hay.	Oat straw or hay.
2d experiment, 1916-1918.	1	Corn, oats, bran (2:2:1).	Lbs. 8.50	Lbs. 811	Lbs. 1,544	Lbs. 1.41	In. 7.68	Lbs. 6.01	Lbs. 7.87	Lbs. 0.63
	2	Corn, oats (1:1).....	8.35	818	1,544	1.40	7.91	5.95	7.38	.63
3d experiment, 1918-1920.	1	Oats, bran (3:1).....	6.36	846	1,482	1.30	6.41	4.90	5.01	3.92
	2	Corn, bran (3:1).....	5.40	853	1,490	1.30	6.84	4.16	5.06	3.91

Of the grain rations, the one fed lot one in the third experiment, and consisting of three parts of crushed oats and one part of bran fed with alfalfa hay supplemented with oat hay, proved most satisfactory. While abundant pasture and legume hays are considered as reducing the grain requirement, it was found best, in the experience gained from these two and the preceding experiment, to feed grain in comparatively small amounts continuously during all seasons.

Breeding Morgan horses at the U. S. Morgan Horse Farm, H. H. REESE (*U. S. Dept. Agr., Dept. Circ. 199 (1921), pp. 18, figs. 13*).—The history of the Morgan horse is reviewed, the characteristics, uses, and value of the breed are pointed out, and the establishment, management, and purpose of the U. S. Morgan Horse Farm at Waybridge, Vt., are discussed. A number of prominent individuals of the breed are figured and described.

Methods of mating poultry, L. S. DODSON (*New Jersey Stas., Hints to Poultrymen, 10 (1921), No. 3, pp. [4], fig. 1*).—Methods of mating poultry,

including large flock, small flock, stud, traveling male, alternating male, and double mating, are described, and the comparative advantages of the different methods are pointed out.

Sex-linked inheritance in poultry, G. LEFEBVRE (*Missouri Sta. Bul. 189* (1921), pp. 58, 59).—This study during the year is reported as having shown that spangling in poultry is a character controlled by a sex-linked factor and that hen-feathering in the males of the Sebright bantam is transmitted through both sexes by a single dominant factor which is not sex linked. No evidence was found that male feathering is due to an internal secretion from so-called luteal cells of the testes.

[**Report on poultry work at the Missouri Station**], H. L. KEMPSTER (*Missouri Sta. Bul. 189* (1921), pp. 47, 48).—In addition to a scratch feed hens were fed a basal mash of 2.2 parts bran and 4.4 parts shorts, supplemented with cottonseed meal 2 or 4 lbs. or with tankage ranging from 0.57 to 3.4 lbs. per pen. The pen fed no protein concentrate averaged 39 eggs per hen, while those fed a small amount of tankage laid 104 eggs. The cottonseed meal appeared to have reduced egg production.

Experiments in feeding chicks clearly indicated the value of sour milk or fresh buttermilk as compared with dried buttermilk and tankage in rations for growing chicks. White Leghorn pullets hatched in February, March, and April appeared to have a larger annual egg production than those hatched in May, and pullets beginning to lay in July, August, and September produced more eggs during the year than were secured from those beginning to lay later. Pullets maturing in less than 175 days were found to be better producers than those requiring a longer period to reach maturity.

[**Report on poultry work at the New Mexico Station**] (*New Mexico Sta. Rpt. 1920*, pp. 29-43, figs. 6).—A report on the progress of work with poultry at the station is made, and the results secured in a study to determine the effect of the time of hatching on the development and production of pullets are presented. The results of a test of different feeds and methods of feeding for bringing cockerels to market weight are given in tables without comment.

Observations made on White Leghorn pullets hatched March 1, March 25, April 24, May 22, and June 15, indicated that for efficient egg production during the fall and winter the pullets should be hatched about April 1 and not later than May 1. The pullets hatched after May 1 required a greater number of days to come into production and had a shorter egg laying period than pullets hatched earlier.

Pullets in a house lighted from 3 a. m. to daylight from November 1 to May 1 reached their maximum production in February, while those in a house without illumination laid the most eggs in March and April. Late hatched pullets with illumination began producing about 1 month sooner than pullets of the same age without illumination. The lot of pullets with illumination produced a greater total number of eggs than were produced by those in the house not lighted.

Poultry keeping in Porto Rico, H. C. HENRICKSEN (*Porto Rico Sta. Circ. 19* (1921), *Spanish ed.*, pp. 22, figs. 14).—This is the Spanish edition of a circular previously noted (*E. S. R.*, 44, p. 871).

DAIRY FARMING—DAIRYING.

[**Report of work at the Iowa Station in dairy husbandry**] (*Iowa Sta. Rpt. 1920*, pp. 27, 28).—Summaries of work in dairy husbandry report among other results that an equally high level of summer milk production can be maintained with feeding either silage or soiling crops, and it is concluded

that when corn costs less than \$1 per bushel, corn silage is the more economical of the two feeds. Rations of milk or of milk and grain failed to maintain normal growth in calves, but the addition of alfalfa hay supplied the deficiency. A substitution of cottonseed meal for oil meal or bran in the ration did not affect the percentage of fat in the milk of dairy cows, but replacing the corn of the ration with cottonseed meal gave a temporary increase of 12 per cent in the fat content of the milk. A study of herd sires indicated considerable variation in their ability to sire daughters of high production. A report of progress is made on breeding work to improve milk production, previously noted (E. S. R., 45, p. 173).

[Report on the work of the dairy department at the Missouri Station], A. C. RAGSDALE ET AL. (*Missouri Sta. Bul.* 189 (1921), pp. 31-35).—The progress made on different projects during the year is briefly reviewed, and the results secured are briefly noted.

Nutrition of heifers: Protein requirement for growth, A. C. Ragsdale and W. W. Swett (pp. 31, 32).—In these experiments various quantities of starch were given in addition to rations consisting of common dairy feeds for the purpose of balancing the ration by furnishing energy. It is reported that normal gains in weight were not made with 25 per cent of total energy supplied by starch plus no other protein than that actually required, and that in only two instances were normal gains in weight made by heifers receiving 15 per cent of total energy under the same conditions. The data available at this time are considered as indicating that 20 per cent of total energy from starch is approximately correct for growing dairy animals of both the Holstein and Jersey breeds.

Raising calves on milk substitutes, A. C. Ragsdale and C. W. Turner (pp. 32, 33).—Calves 2 weeks old were gradually changed from a ration of whole milk to one of skim milk and had been well started on a supplementary grain mixture with hay when about 60 days old. At this time the skim milk was discontinued and only grain and hay were fed. The use of soy bean hay and a mixture of corn chop, wheat bran, and oil meal (4:1:1) gave better average results for two years than a ration of alfalfa hay and corn chop, wheat bran, and soy bean meal 4:1:1. Until the calves became accustomed to the dry feed poor growth was made, but later there was a tendency toward large gains. Soy bean hay appeared more palatable than alfalfa hay.

Factors influencing the percentage and quantity of the fat in the milk of cows on official test, A. C. Ragsdale, C. W. Turner, and S. Brody (pp. 33, 34).—Observations were made on 10 animals during March and April under winter conditions of food, shelter, and exercise. Each milking was tested for butter fat, and an hourly record of temperature and any unusual weather conditions was kept. The results showed an increase of about 0.15 per cent of fat for a decrease in temperature of 10° F. When the feed was reduced by 50 per cent for 3 days a gradual increase in the percentage of fat, reaching its maximum the third day and after that a considerable drop below the average for a few days, was observed. The study of 3,763 Guernsey, 299 Jersey, and 95 Holstein records indicated a general decline in the fat content of the milk during the second month, followed by a gradual increase during the remainder of the lactation period. In studying the influence of season on the percentage of fat in cow's milk the tests were found low in the summer months, while there was a gradual rise during the winter months beginning in October and reaching its maximum during December, January, and February. The variation of fat in successive fractions of a milking is considered due to the action of gravity. When the udder was manipulated sufficiently the fat in successive 100 cc.

fractions drawn every 2 hours was nearly the same. Similar work has been noted previously (E. S. R., 45, p. 276).

Silage investigations, A. C. Ragsdale, and C. W. Turner (p. 34).—Losses in the weight of silage from corn were found to average 6.08 per cent, as compared with 4.98 per cent in silage from stover. The average yield per acre of both grain and stover was 20,505 lbs. for Cocke Prolific, 18,878 lbs. for Bigg Seven-ear, 18,383 lbs. for Eureka, and 14,387 lbs. for Leaming. The yields of grain and stover were in practically the same proportion as the total yields.

The effect of each ingredient in the manufacture of ice cream, W. H. E. Reid and D. H. Nelson (pp. 34, 35).—The fat content was found to vary directly with the viscosity and inversely with the weight of a given volume of mix. With a high fat content the mix containing more total solids required more time to begin freezing but less time for whipping because the greater viscosity facilitated the incorporation of the air. It was observed that as the fat content increased the temperature of the ice cream increased if hardened at the same temperature. Ice cream containing 8 per cent or more of fat was found to develop an old taste when stored for 5 days or longer, which was not noticed in cream with only 4 or 6 per cent of fat. A fat content of 8 to 12 per cent in ice cream is considered best for market purposes.

[*Work in dairy husbandry at the New Mexico Station*] (*New Mexico Sta. Rpt. 1920*, pp. 43, 44).—Eight native does bred to a purebred Toggenburg buck produced 13 kids, all of which except four showed marked Toggenburg color markings. Two white does produced kids almost pure white, and one of the kids of a blue doe was gray with no Toggenburg characteristics. The eight does averaged 1.2 qt. of milk per day for the first 60 days of their lactation periods, the range being from 0.8 to 2.1 qt.

Sunflower silage and corn silage were fed to dairy cows by the reversal method in 22-day periods. While eaten as readily as the corn silage, the sunflower silage did not give as good results. The four cows receiving sunflower silage produced 1,915 lbs., and those receiving corn silage 1,942 lbs.

[*Silage as a substitute for hay*], W. E. ASHTON (*Jersey Bul. and Dairy World*, 41 (1922), No. 4, p. 168).—A successful feeding practice is briefly noted in which corn silage and a grain allowance are fed twice a day and a final daily feed of oat straw is given as an entire substitute for hay in the ration of dairy cows.

Studies of dairy cattle, J. J. HOOPER and P. E. BACON (*Kentucky Sta. Bul. 234* (1921), pp. 91-161, figs. 24).—This bulletin reports the results of five different studies.

1. *Inheritance of color markings in Jersey cattle*, J. J. Hooper (pp. 95-114).—Some of the results of this study have been noted (E. S. R., 42, p. 472). In addition to the data there reported, it was found that of the Jersey cattle studied 66 per cent were solid in color and had black tongues and black switches, 12 per cent were broken in color, with white tongues and white switches, and 22 per cent had various combinations of tongue, body, and switch color. It appeared further that each part has a separate determiner in the inheritance of color. The yellow nose appeared recessive, and the gray nose, it was thought, should be classed genetically with black noses, as a dominant. Gray color was dominant, apparently, to all other coat colors.

2. *Influence of oestrus or heat on the production of milk and butter fat*, J. J. Hooper and P. E. Bacon (pp. 115-118).—The results of this work here tabulated and briefly discussed have been noted (E. S. R., 40, p. 878).

3. *Influence of age and pregnancy on the production of milk and butter fat in Jersey cows*, J. J. Hooper (pp. 119-125).—This study, based on the records of

1,497 register of merit tests, showed that the open cows slightly exceed the pregnant cows in the production of milk and butter fat. Similar work has been noted (E. S. R., 46, p. 74).

The results showed also that the 2-year-old cows produced 74 lbs. of milk and 73 lbs. of butter fat for every 100 lbs. produced by mature 7-year-old cows. Three-year-old cows produced 81 lbs., 4-year-old cows 94 lbs., 5-year-old cows 92 lbs., and 6-year-old cows 96 lbs. of butter fat, compared with 100 lbs. for the 7-year-old cows.

4. *The escutcheon in relation to production of milk and butter fat*, J. J. Hooper (pp. 126-158).—The work here described has been noted (E. S. R., 41, p. 572). The study of 476 records of dairy cows failed to reveal any correlation between the shape and size of the escutcheon and the production of milk and butter fat. It was observed in the cows examined that when the escutcheon was not symmetrical it was largest on the left side, and also that the largest feathers were found on the left side of the vulva.

5. *The body secretions in relation to production of milk and butter fat*, J. J. Hooper (pp. 159-161).—An inspection of 164 cows failed to show a correlation between the amount or color of body secretions and the yield of milk or butter fat.

Germ content of milk.—III, As influenced by visible dirt, H. A. HARDING and M. J. PRUCHA (*Illinois Sta. Bul.* 236 (1921), pp. 363-391, fig. 1).—The observations reported in this bulletin continued previous work (E. S. R., 38, p. 878), and were divided into three general groups: (1) A study, extending over about two years, of the germ content of 1,665 samples of milk from cows in three different barns, the cows differing in cleanness but all kept reasonably clean; (2) a brief intensive study of 250 samples from cows allowed to become excessively dirty; and (3) a study of the dirt from the coats of cows as a source of germs in the milk. In addition, observations were made on the effect of cleaning the coats of the excessively dirty cows and of using the ordinary open type and the small topped milk pails. Methods of determining the amount of dirt in milk and the sources, kinds, and amounts of dirt in milk are discussed. The term "dirt in milk" is used to designate the foreign matter ordinarily visible.

The results showed in general that a relatively small quantity of dirt enters the milk in milking and that where a time interval permits bacterial growth, the germ content can not be taken as indicating the degree of cleanliness surrounding the production of a given sample of milk. The unstrained milk from extremely dirty cows milked into the open-topped pail, having a diameter of about 12 in., was found to contain 10.8 mg. of dirt per quart, and this to have been reduced to 8.1 mg. by the use of the small-topped pail with an opening 5 by 7 in. The milk from the cows after their coats were cleaned and with the use of the small-topped pail contained 4.6 mg. per quart on the average for the series of milkings.

The dirt from the extremely dirty cows showed through plate counts approximately 1.5 billion germs per gram, yet the increase in the germ count in the milk due to the presence of 10.8 mg. of dirt per quart was only about 17,000 per cubic centimeter, and in the milk with 8.1 mg. of dirt per quart it was 13,000 per cubic centimeter. It is pointed out that in ordinary milk production germ counts as low as 17,000 per cubic centimeter resulting from any factor are entirely overshadowed by the influence of utensils and other factors, and that protection against dirty milk must be based largely on determinations of the dirt actually present rather than on germ counts.

VETERINARY MEDICINE.

The evolution of disease, J. DANYSZ, trans by F. M. RACKEMANN (*Philadelphia: Lea & Febiger, 1921, pp. XII+17-194, fig. 1*).—This is an English translation of the volume in which are presented the author's theories concerning the evolution of disease from the standpoint of immunity, anaphylaxis, and antianaphylaxis. Some of the phases of the subject have been previously noted from other sources (*E. S. R., 39, pp. 79, 285*).

The principles of bacteriology, A. C. ABBOTT (*Philadelphia: Lea & Febiger, 1921, 10. ed., rev., pp. X+17-686, pls. 11, figs. 108*).—This is the tenth edition of this textbook and laboratory manual of bacteriology. The first half of the book is devoted to a general survey of the principles of bacteriology and bacteriological technique and the second half to the application of the methods of bacteriology to the study of special pathogenic microorganisms, with a final chapter on the bacteriological study of water.

[**Report of the**] **department of veterinary science**, H. WELCH (*Montana Sta. Rpt. 1920, pp. 34-36*).—Work with goiter and hairlessness indicates that feeding sows potassium iodid at the rate of 5 grains once a week gives as satisfactory results as does the administration of 1 grain daily. The use of 10 per cent nitric acid cured the milder cases of a strictly venereal and virulent form of necrobacillosis of sheep. Experimental work has shown that ordinary compressed yeast is a valuable tonic and corrective in cases of indigestion, lack of condition, and other chronic conditions due to faulty feeding. The administration of from 4 to 6 oz. of kerosene in a pint of milk, oil, and in some cases water, have shown it to be a most valuable agent for the treatment of cattle bloated from feeding on alfalfa, clover, or potatoes, or from indigestion.

The loco weed eradication work conducted during the summer is noted on page 334.

Cresols and substances for cresol soaps, III, IV, E. HAILER (*Arb. Reichsgesundheitsamt., 52 (1920), No. 4, pp. 670-726*).—In continuation of the investigation previously noted (*E. S. R., 45, p. 579*), two papers are presented.

III. Salts of cresotin acid as solvents for cresol (pp. 670-695).—The so-called cresotin acids used in this study are ortho-, meta-, and para-toluy acids or homosalicyclic acids prepared from cresol, carbon dioxide, and sodium hydroxid. The sodium salts of the three isomeric acids differ in their solubility in water and in their solvent action on cresol. The usual combination for disinfecting purposes is 20 parts of the sodium salt of ortho-cresotin acid, 30 parts of water, and 50 parts of cresol. This preparation is sold under the name of Cresotin-Cresol. The experimental work reported in this paper consists of a study of the bactericidal properties of the various cresotin salts, the influence of increasing proportions of sodium ortho-cresotinate on the bactericidal properties of cresol solutions, and a comparison of the bactericidal properties of cresotin-cresol, pure aqueous solutions of cresol, and varying dilutions of cresol soaps as determined by test with 11 strains of staphylococci.

The data presented show that a dilution of cresotin-cresol furnishing 1 per cent cresol has as strong bactericidal properties as pure aqueous solutions of cresol and stronger than cresol soaps of such a dilution as to contain 2.5 per cent of cresol.

IV. Methods of testing the disinfecting properties of cresols (pp. 696-726).—In this paper the author reports a comparative study of methods of testing the bactericidal properties of disinfectants (1) by saturating pieces of cotton cloth with cultures of the organism tested, drying the cloth, exposing it for varying periods of time to the disinfectant under examination, and then cul-

turing it on suitable media; and (2) by transferring some of the culture of the organism to a given amount of disinfectant and culturing after varying lengths of time.

The conclusion is drawn that the first method, which is the one employed in the above and previous studies of this series, is of greater accuracy than the so-called suspension method.

On the essential identity of the antibodies, H. ZINSSER (*Jour. Immunol.*, 6 (1921), No. 5, pp. 289-299).—In this theoretical discussion of the nature of antibodies, the author presents arguments in favor of the "unitarian" view of the essential identity of agglutinins, precipitins, bacteriolysins, etc.

Cutaneous vaccination: Anthrax, skin infection, skin vaccination, and skin immunity, A. BESREDKA (*Ann. Inst. Pasteur*, 35 (1921), No. 7, pp. 421-430).—Essentially noted from another source (*E. S. R.*, 44, p. 877).

The local and general serum treatment of cutaneous anthrax, J. C. REGAN (*Jour. Amer. Med. Assoc.*, 77 (1921), No. 25, pp. 1944-1948).—The author reports further success in the treatment of anthrax (human) by local injections of antianthrax serum as previously described (*E. S. R.*, 41, p. 189), together with intravenous injections of the serum. A tentative plan of dosage combining the local and general injections is outlined.

Blood prevention and blood vaccination in foot-and-mouth disease, H. VALLÉE and CARRÉ (*Rec. Méd. Vét.*, 97 (1921), No. 13, pp. 369-372; *abs. in Trop. Vet. Bul.*, 9 (1921), No. 4, pp. 249-251).—From a comparative study of the results reported in the literature and obtained by the authors in experimental work on the immunization of cattle against foot-and-mouth disease by injections of blood or serum from animals cured of the disease, the following conclusions are drawn:

Owing to the fact that cattle recovered from foot-and-mouth disease do not all furnish blood of equal activity, a mixture of blood from several animals should be used in preference to that of a single animal. The blood should be drawn on the twelfth to the fifteenth day after the appearance of vesicles. If treated with an antiseptic the citrated blood can be kept in the ice box at 1° C. for at least three months without loss of potency. It should be used in doses of not less than 1 cc. of blood for 1 kg. body weight of the animal to be immunized, whatever the species.

The duration of the immunity conferred does not exceed 15 days in the majority of cases, but may be prolonged for equal periods of time by a second or third injection. The only animals that can be protected in this way are those which are still free from infection at the time of vaccination. In animals inoculated during the period of incubation the disease, however, takes a more benign course.

Attempts to produce lasting immunity have been made by inoculating cattle and sheep with the blood of recovered animals and simultaneously or a few days later with doses of from 1 to 10 cc. of defibrinated virulent blood or with lymph of filtered macerated epithelium from diseased animals. The duration of the immunity thus produced has not yet been determined.

Observations concerning blood vaccination for foot-and-mouth disease in 1920 in the Canton of Lucerne, E. ODERMATT (*Schweiz. Arch. Tierheilk.*, 63 (1921), No. 9, pp. 347-365, fig. 1).—This paper reports a summary of data obtained from questionnaires sent out following the campaign against foot-and-mouth disease in the Canton of Lucerne, Switzerland, in 1920. A total of 8,672 animals, including steers, milch cows, beef cattle, calves, and swine, were vaccinated and 1,880 sick animals and 1,282 well ones were not vaccinated. The mortality among the vaccinated was 2.2 per cent and among the unvaccinated 23.05 per cent. The milk yield was favorably influenced in 87.14 per cent of

the vaccinated animals. Accidents following vaccinations occurred seldom. In the whole campaign of 1920 only six animals had to be slaughtered following vaccination on account of septic abscesses traceable to poor technique of vaccination. The method recommended as most satisfactory is that described by Zschokke and Zwicky (E. S. R., 45, p. 580).

The immunity conferred by the milk of animals cured of foot-and-mouth disease, C. LEBAILLY (*Compt. Rend. Soc. Biol. [Paris]*, 84 (1921), No. 4, pp. 180, 181).—Failure to reproduce foot-and-mouth disease in young pigs by injections of from 5 to 10 cc. of virulent blood is thought by the author to indicate that the pigs had acquired immunity through the ingestion of milk from cows cured of the disease. The author is of the opinion that by feeding such milk a temporary immunity to the disease may be established.

Procedure for the rapid production of serum against rinderpest, R. VAN SACEGHEM (*Bul. Soc. Path. Exot.*, 14 (1921), No. 7, pp. 367, 368).—Essentially noted from another source (E. S. R., 45, p. 883).

Studies on the tuberculin reaction and on specific hypersensitiveness in bacterial infection, H. ZINSSER (*Jour. Expt. Med.*, 34 (1921), No. 5, pp. 495–524, pls. 4).—This paper reports at length an investigation of the tuberculin reaction in guinea pigs with a view to determining the relationship of the intracutaneous tuberculin reaction to anaphylaxis.

Attention is first called to the two different types of skin reaction in man and in guinea pigs following the injection of antigen: (1) The immediate transitory reaction which develops in animals sensitized to proteins; and (2) the delayed tuberculin type of skin reaction. The first type is shown to be one of the manifestations of general protein hypersensitiveness or anaphylaxis, and the second, which develops more slowly and leads to a more profound injury of the tissues, to be independent of anaphylaxis as ordinarily understood. The tuberculin type of hypersensitiveness does not develop in guinea pigs sensitized with proteins like horse serum so far as has been observed, but only through infection with living organisms. In animals made hypersensitive to this type of reaction the reaction may be induced by intradermal injections of the proteose residue of bacterial extracts after the true proteins have been destroyed by the action of acids, etc.

In discussing the rôle which this form of sensitization plays in the symptomatology and pathology of infectious diseases, the author suggests "it would appear that certain noncoagulable substances of uncertain chemical constitution are being constantly elaborated in the course of bacterial growth and passed into the circulation of infected animals. As a result of this, infected animals become sensitized to these heat- and acid-resistant materials, in tuberculosis in the course of one to two weeks, in the case of more rapidly growing bacteria perhaps sooner. Early in the course of infection, the animal becomes sensitized and subsequently the further elaboration and distribution of these materials from the bacterial focus play a fundamental part in the injury of the animal. These proteose-like substances, like tuberculin, possessing but slight toxicity for the normal animal, become highly toxic to the sensitized one. Thus, these substances, while not being true exotoxins in the ordinary sense, would still represent a highly toxic bacterial product comparable in its injurious effect to toxins when produced in the body of an animal thus sensitized."

Investigation of the antigenic value of bacillary emulsions and of ethyl and methyl extracts of tubercle bacilli, L. NÈGRE and A. BOQUET (*Ann. Inst. Pasteur*, 35 (1921), No. 5, pp. 300–314).—As the result of a comparative study of the antigenic value of emulsions of bile-treated tubercle bacilli and of bacillary extracts in ethyl alcohol with and without preliminary treatment with

acetone, the authors recommend as the most satisfactory antigen a methyl alcohol extract of tubercle bacilli prepared as follows:

Human and bovine bacilli from 6-week cultures in glycerinated bouillon are sterilized by heating for 30 minutes at 120° C., filtered on paper, and mixed in equal quantities. The bacilli are then washed on the filter paper with distilled water, dried in the oven or in vacuo, treated with acetone for 24 hours (1 cc. of acetone for 0.01 gm. of the bacilli), dried again, and finally macerated in methyl alcohol in the same proportions. The extraction is continued for from 10 to 12 days at a temperature of from 37 to 38°, with frequent shaking. The filtered liquid is used in doses of from $\frac{1}{20}$ to 1 cc. of a 1:20 dilution in physiological salt solution, prepared at the time of use by warming the antigen for a few minutes at 50° and adding it gradually to the salt solution.

Notes on the control of bovine tuberculosis, J. TRAUM and S. LOCKETT (*Jour. Amer. Vet. Med. Assoc.*, 60 (1921), No. 2, pp. 186-190).—These notes from the California Experiment Station include observations on the time of appearance of the local reaction in the intradermal tuberculin test and suggestions for the mode of procedure in establishing a tuberculosis-free herd from a badly infected one. From observations during the intradermal test on a badly infected herd and from previous experience, the authors are of the opinion that for the best results two readings should be made, the first between the forty-eighth and seventy-second hours and the second at the one hundred twentieth hour, or if only one reading is possible it should be made either at the seventy-second or the ninety-sixth hour.

In place of indiscriminate slaughter of reacting animals the segregation of the newly born calves in an environment entirely free from possible contamination by the old herd, to serve as a nucleus of a new herd, is considered the best means of establishing a tuberculosis-free herd.

Infectious abortion of cattle, J. W. CONNAWAY, A. J. DURANT, and H. G. NEWMAN (*Missouri Sta. Bul.* 189 (1921), pp. 57, 58).—This is a progress report in continuation of the studies previously noted (*E. S. R.*, 43, p. 784). Experiments to determine the effect of a more or less prolonged rest from breeding on the persistence of *Bacterium abortus* in abortion-infected cows have shown that such cows do not have the power to destroy and eliminate the infecting organism. On the other hand, infected calves soon become nonreactors unless reinfected by subsequent exposure. Unbred heifers do not become reinfected by continuous exposure to nonpregnant reacting cows.

A bacteriological study of the glandular organs of a mature steer, cow, and bull which had been artificially infected with *B. abortus* gave evidence that the steer was apparently less able to destroy and eliminate the organism than the bull, but that neither is as favorable a host for the organism as the cow. In the cow the generative organs are more apt to suffer functional disturbances as the result of infection with *B. abortus*, while the udder affords favorable conditions for the parasitic existence of the organism.

For the prevention and eradication of infectious abortion from a cattle herd, the authors suggest testing the entire herd at regular intervals to determine the presence of reactors, disposing of all reactors that are of no special value, isolating promptly every animal showing a tendency to premature calving, keeping the reactors away from the main herd at calving time, destroying all dead calves and afterbirths by burning or burying deeply, disinfecting the cow barns and stable litter, and spraying with a disinfectant the cows that have recently calved.

Contagious agalaxy of the sheep and goat: Experimental study, H. CARRÉ (*Ann. Inst. Pasteur*, 35 (1921), No. 5, pp. 332-337).—This is a brief report of a continuation from 1912 to 1914 of a previously noted investigation

on contagious agalaxy (E. S. R., 29, p. 179). The author emphasizes again the persistence of the virus in the mammary gland for as long as six months after infection and the great danger of scattering the infection through this source. Vaccination of a lactating animal, while protecting the animal from general infection, does not protect the mammary gland, which becomes the seat of local infection.

Infectious abortion in swine, J. W. CONNAWAY, A. J. DURANT, and H. G. NEWMAN (*Missouri Sta. Bul.* 187 (1921), pp. 28, figs. 11).—This is a progress report to the date of June 15, 1921, of investigations on infectious abortion in swine, preliminary reports of which have been previously noted in the annual reports from the station (E. S. R., 37, p. 779; 43, p. 784). The following facts regarding the disease appear to have been established:

The specific cause of the majority of abortions in swine is an organism closely related to, if not identical with *Bacterium abortus* of Bang, which is responsible for the majority of abortions in cattle. The probable identity of the causative agents of abortion in swine and in cattle has been proved by complement fixation and agglutination tests, by the isolation and identification of the specific organism, by the production of the specific abortion reaction in the blood of swine, by inoculation of swine with cattle abortion bacteria, and by field observations of abortions in cattle and swine pastured together.

The chief mode of transmission of the infecting organism appears to be ingestion of material contaminated with the organism. Transmission by breeding is probable but not definitely proved. Boars, nonpregnant sows, and young pigs are susceptible to infection. In the case of the young animals the blood reaction generally becomes negative in a few weeks, while in mature sows the infection is retained for some time, if not permanently, although sows which have aborted and continue to react may farrow full term living pigs at the next gestation.

The measures suggested for the prevention and control of the disease are similar to those which are in general use in the case of contagious abortion in cattle. The abortion test should be applied to all mature breeding animals in the herd and to recently purchased animals. Aborting sows should be promptly isolated from the herd, and care should be taken to disinfect thoroughly the premises and destroy the aborted pigs and afterbirths. Whether the reactors should be fattened and sold to the butcher or kept depends upon the special value of the animal. In the case of a valuable sow it is considered best to keep it for breeding purposes and isolate the litters directly after weaning. Vaccination is considered of doubtful value and probably detrimental in that it introduces the possibility of making permanent infection carriers of the immunized animals.

Directions are given for making and interpreting the serological tests for infectious abortion, and for caring for the aborting sows, the nonreactors, and boars in the infected herd. Illustrations and descriptions of a number of experimental cases of infectious abortion in swine, and a list of 16 literature references, are given in an appendix.

Botulism in swine and its relation to immunization against hog cholera, R. GRAHAM (*Jour. Amer. Vet. Med. Assoc.*, 60 (1921), No. 1, pp. 76-79).—An investigation of the post-vaccination illness in swine sometimes following vaccination for hog cholera has shown that the tissues of the afflicted animals often contain, in addition to *Bacillus suispestifer*, related organisms of the paratyphoid group and *B. necrophorus*, organisms closely related to or identical with *B. botulinus*, type A. The symptoms of the illness can also be reproduced

by injecting swine with hog cholera serum and virus, together with varying amounts of botulinus toxin. An examination of 74 samples of commercial hog cholera serum and virus showed the presence of *B. botulinus*, type A, in 16 per cent of the samples—10.8 per cent in the virus, and 5.2 per cent in the serum.

The author is of the opinion that while hog cholera is the predominating disease in post-vaccination illness in swine, its development is "traceable to the fact that the serum and virus treatment is simultaneously superimposed upon a specific botulinus intoxication which lowers the resisting powers of the animals and permits the development of a latent and low grade cholera." It is recommended that to avoid loss subsequent to the immunization of swine with commercial hog cholera serum and virus as at present prepared, a prophylactic injection of botulinus antitoxin (500 units) should be given. Such treatment is thought to be justified further on the ground of possible infection from contaminated rations following immunization to hog cholera.

Hog cholera immunity and associated problems.—Transmission of tuberculosis by antihog-cholera serum and virus, J. W. CONNAWAY, O. S. CRISLER, A. J. DURANT, and H. G. NEWMAN (*Missouri Sta. Bul.* 189 (1921), p. 58).—The authors conclude that while tubercle bacilli circulate in the blood of tuberculous swine and it is possible to transmit the disease by inoculation into other swine, there is little danger in carefully conducted antihog-cholera serum laboratories of contamination of serum and virus with tubercle bacilli and of thus communicating tuberculosis to swine through immunization against hog cholera.

Hemotoxins from parasitic worms, B. SCHWARTZ (*Jour. Agr. Research* [U. S.], 22 (1921), No. 8, pp. 379-432).—This is a report of investigations by the Bureau of Animal Industry, U. S. Department of Agriculture, conducted in connection with the studies previously noted (E. S. R., 45, p. 477). After brief introductory remarks, the literature on hemotoxins and parasitic worms is reviewed at length and a summary drawn. Technic, next considered, is followed by accounts of experiments with hemolytic extracts and *Ascaris lumbricoides*, agglutinating substances from *A. lumbricoides*, the effect of *A. lumbricoides* fluid on coagulation of blood, and with hookworm hemolysin (*Ancylostoma caninum*). Experiments with extracts of cattle hookworms (*Bufolebotomum phlebotomum*), on the possible presence of anticoagulins in hookworms; extracts of *Haemonchus contortus*, with *Trichuris depressiuscula* extract, with Cestode hemolysins, etc., follow.

In summarizing the work it is found that "extracts of *A. lumbricoides* contain active substances that affect blood deleteriously. The hemolysin which these extracts contain is a thermostabile, nonspecific, alcohol-soluble substance which appears to be rather firmly bound to the cells of the parasite, presumably to the cells of the intestine in which it is elaborated. The hemolytic potency of extracts of *A. lumbricoides* is not due solely to fatty acids, since chemical fractions of the worms from which the fatty acids have been removed by ether extraction are hemolytic. The hemolysin is neutralized by normal blood serum. The body fluid of *A. lumbricoides* shortly after removal from the host contains oxyhemoglobin and is nonhemolytic. It acquires hemolytic powers, however, as the worms are kept alive in vitro for a few days, and loses at the same time its oxyhemoglobin content. Body fluid from fresh specimens of *A. lumbricoides* does not activate a hemolytic system, and alcohol-soluble fractions of the worms from which ether-soluble substances have been removed does not act as complement in combination with inactivated normal guinea pig serum. The hemagglutinin from *A. lumbricoides* is a salt-solution-soluble substance and has special affinities for rabbit blood cells. Unlike the

hemolysin, its action is not hindered by low temperatures (6 to 8° C.). *A. lumbricoides* secretes a substance that inhibits the coagulation of blood. This substance is present in the body fluid of the worm and has but comparatively slight potency.

"*Ancylostoma caninum* secretes a nonspecific hemolysin, soluble in salt solution, relatively thermolabile and inactive at low temperatures. Normal blood serum inhibits the action of the hookworm hemolysin. *B. phlebotomum* secreted a hemolysin having properties similar to that of *A. caninum*. This hemolysin is completely soluble in alcohol. Salt-solution extracts of *H. contortus* have but a feeble hemolytic action. Salt-solution extracts of *A. caninum* and of *B. phlebotomum* do not inhibit the coagulation of rabbit blood to any marked degree. A weak hemolytic substance is present in extracts of *T. depressiuscula*. *Thysanosoma actinioides* contains an alcohol-soluble hemolysin. Alcohol-soluble fractions of *T. actinioides* from which the ether-soluble fraction has been removed are hemolytic, showing that substances other than fatty acids are involved. The hemolysin from this cestode is active at 8° and is neutralized by normal blood serum. Extracts of a species of *Moniezia* similar to those of *T. actinioides* are nonhemolytic. The view that hemolysins and other hemotoxic secretions of parasitic worms are of etiological importance in parasitic diseases appears to be well founded."

A list of the literature cited, consisting of five pages, is included.

RURAL ENGINEERING.

Rainfall and run-off studies, C. E. GRUNSKY (*Amer. Soc. Civil Engin. Proc.*, 47 (1921), No. 7, pp. 203-242, pl. 1, figs. 9).—In connection with the approximation of the water production of watersheds, data are presented to show the range of precipitation in climatic years in the central portions of California and also the frequency of climatic years with various amounts of precipitation. The difference is pointed out between the normal run-off from any watershed and the probable run-off that is to be expected in a single season in which the rainfall is normal. The effect of altitude on the intensity of rainfall and on the run-off is discussed, and it is shown that the lower temperature at high altitudes diminishes evaporation and consequently increases run-off.

Formulas are presented for the calculation of maximum storm-water flow from small and large areas after the maximum rain intensity for various time periods has been ascertained. A brief reference is also made to evaporation, and a table and a formula are presented for estimating the evaporation from known mean monthly temperatures.

Tables for designing nonpressure water and sewer tunnels, J. HINDS (*Engin. News-Rec.*, 87 (1921), No. 17, pp. 693, 694).—In a contribution from the U. S. Reclamation Service, tables of data are given for velocity head and discharge at critical depths and static pressures in circular and horseshoe conduits partly full.

Report of hydrometric surveys in the Provinces of Alberta and Saskatchewan for the year ended September 30, 1919, A. L. FORD, G. H. WHYTE, and F. K. BEACH (*Canada Dept. Int., Reclam. Serv., Water-Supply Bul.* 11 (1921), pp. 391, pl. 1).—This bulletin presents the results of measurements of flow made on streams in the Provinces of Alberta and Saskatchewan for the year ended September 30, 1919.

Routes to desert watering places in the Mohave Desert region, Calif., D. G. THOMPSON (*U. S. Geol. Survey, Water-Supply Paper* 490-B (1921), pp. VII+269, pls. 15, figs. 3).—This report, prepared in cooperation with the State

of California, contains a preface by O. E. Meinzer. It consists principally of logs of the usual routes of travel in the desert part of San Bernardino County, Calif., and adjoining parts of Los Angeles and Kern Counties.

Proceedings of the ninth annual meeting of the National Drainage Congress (*Natl. Drainage Cong. Proc.*, 9 (1920), pp. 57, pl. 1).—These proceedings contain the following special articles of engineering interest: Progress of Drainage in the Southern States, by S. H. McCrory; Tiling Peat Marshes, by E. R. Jones; Work of the Water Resource Branch of the U. S. Geological Survey in Its Relation to Drainage, by N. C. Grover; A Review of the Drainage Situation in Illinois, by F. W. DeWolf and G. W. Pickels; Abstracts from State Laws on General Tax and State Aid for Drainage; by J. A. Hale; Assessments of Cost for Drainage Works, by C. G. Elliott; The Necessity for Drainage in the South, by J. M. Moore; Water Power Development in the South, by M. M. Jackson; Excavating Machinery, by G. B. Massey; Successful Reclamation of Swamp and Overflowed Lands in North Carolina, by J. H. Pratt; and Mosquito and Malarial Control, by H. C. Woodfall.

Tests of road materials of Indiana (*Purdue Univ., Engin. Expt. Sta. Bul.* 7 (1921), pp. 55).—This bulletin describes and presents the results of tests of road materials in Indiana, made by the laboratory for testing materials of Purdue University during the past 20 years.

The thermal conductivity and diffusivity of concrete, A. P. CARMAN and R. A. NELSON (*Ill. Univ., Engin. Expt. Sta. Bul.* 122 (1921), pp. 39, figs. 6).—Investigations are reported, the object of which was to obtain the absolute thermal conductivity of a number of standard concrete mixtures. The diffusivity was also calculated from the specific heat, density, and thermal conductivity. Similar determinations were also made for white marble for comparative purposes.

Cement in aggregate mixtures of 1:2, 1:3, 1:4, 1:5, 1:7, and 1:9 were used, and a neat cement was also tested. Three consistencies were used in the mixtures, the normal consistency being referred to as 100 per cent water content and two others with 10 and 20 per cent additional water, respectively. It was found that the neat cement had a much lower thermal conductivity than any of the sand and gravel concrete mixtures. The thermal conductivity of the neat cement was scarcely half of that of the 1:2 mixture. In the case of the sand and gravel concrete mixtures there was practically no difference in thermal conductivity due to the relative richness or leanness in cement for a temperature range of from 100 to 200° C.

The voids in the sand and gravel concrete mixtures, as calculated from the values for densities of the various materials, ranged from 16 to 20 per cent, while in the case of the neat cement the percentage of voids was about 42. It is considered probable that the proportion of solid material to voids to a large extent determines the conductivity, and that this accounts for the lower thermal conductivity of the neat cement. The thermal conductivity of marble was found to be much greater than that of a concrete mixture.

As far as consistency was concerned the maximum thermal conductivity occurred with a relative water content of about 110 per cent, while for relative water contents of 100 or 120 per cent, the thermal conductivity was generally lower. Each had little effect, if any, on the thermal conductivity of concrete. There was only very slight, if any, change of conductivity with change of temperature for concrete, while for marble there was a marked decrease in conductivity with rise of temperature.

"For the more commonly used concrete mixtures, that is, those with proportions of cement to aggregate of 1:3 to 1:7, the following average values

of thermal conductivity and thermal diffusivity appear established: For the c. g. s. physical unit system, for the range of temperature between 50 and 200°, the average thermal conductivity is 0.00366, and the average thermal diffusivity, 0.00719; for the British engineering unit system, for the range of temperatures between 120 and 390° F., the average thermal conductivity is 0.904, and the average thermal diffusivity, 0.0503. These values are for thoroughly dry concrete of the stone-concrete mixture described.

"While the values for such physical constants as thermal conductivity and thermal diffusivity, for a material like concrete, are necessarily averages, and subject to the variation of averages, yet they are probably as definite as other physical constants for structural materials, and particularly so when the average values are obtained for a considerable number of specimens, as in this investigation."

Physical properties of some South Australian-grown pines, R. W. CHAPMAN (*Roy. Soc. So. Aust. Trans. and Proc.*, 43 (1919), pp. 405-417, figs. 4).—A study of the physical and mechanical properties of the Canary Island, Remarkable, and Maritime pines of South Australia are reported. The study included over 350 tests on the three species of pine.

A marked difference was noticed between the weights of timbers of the same species from different trees. This was true in the case of the Remarkable pine even when the specimens were dried to approximately the same percentage of moisture content. The results of the tests on the seasoned wood also indicated that this difference in weight was accompanied by a corresponding difference in strength. With the exception of the beam tests the strengths were very nearly proportional to the densities, although density is evidently by no means the only factor in determining the strength of woods even of the same species. The tests comprised measurements for shrinkage with seasoning, transverse strength, shearing strength, and compressive strength, both longitudinally and transversely.

Studies of the variation of strength with moisture content showed that the strength of the wood was the same whether the moisture was obtained from soakage, in water or from the natural sap. The compressive strength of Remarkable pine decreased very rapidly as the moisture increased from 10 per cent to 25 per cent of the dry weight, beyond which point the decrease in strength was much less marked. Similar results were obtained with the other two pines.

Further experiments showed that wood, when placed in water, not only increases in weight by absorption but expands in volume. Blocks of Canary Island and Remarkable pine exerted average maximum pressures under expansion by moisture of 128 and 139 lbs. per square inch, respectively. There was a marked difference in the behavior of heartwood and sapwood as regards absorptive power. Tests with Maritime pine showed that the sapwood absorbed up to 170 per cent moisture, but under the same conditions the heartwood absorbed only 45 per cent.

The average results of all the strength tests showed the very great superiority in all respects of the Canary Island pine.

The cause and prevention of decay in structural timber, R. J. BLAIR (*Jour.-Engin. Inst. Canada*, 4 (1921), No. 11, pp. 565-568, figs. 6).—In a contribution from the Forest Products Laboratories of Canada, it is shown that timber decay results from the attack of a wood-destroying fungus which requires moisture in order to grow. Only wood that is properly moist offers an attractive location for the fungus, and its development may be avoided either by keeping the wood dry and thus withholding the moisture required

or else by using a wood preservative which acts as a poison and prevents growth. It is stated that in practice all wood exposed to the weather in contact with the soil or in moist situations should be given preservative treatment, while in buildings the moisture relations necessary for fungus growth may be controlled by the installation of efficient heating and ventilating equipment.

Methods of prolonging the durability of fence posts, J.-A. ROY (*Quebec Soc. Protect. Plants Ann. Rpt.*, 13 (1920-21), pp. 57-65).—Information is given on methods and apparatus for the preservative treatment of fence posts, including cost figures for different treatments.

Preservative treatment of fence posts (*Iowa Sta. Rpt.* 1920, p. 49).—The results of a 15-year service test of fence posts, untreated and treated with creosote by the open-tank method, showed that at the end of the period a large percentage of the treated posts were sound. The untreated posts lasted only from three to five years. The results indicate the desirability of using the inferior softwoods of the State for fencing purposes and the economy incident to creosoting white cedar and other posts shipped in from other States.

Roofing materials (*Iowa Sta. Rpt.* 1920, p. 7).—A 7-year study of 35 brands of 3-ply prepared roofing, including physical, chemical, and weathering tests, has so far indicated that a protective layer of mica, sand, or crushed stone has a beneficial influence upon durability.

Export packing, C. C. MARTIN (*New York: Johnston Export Pub. Co.*, 1921, pp. VI+723, pl. 1, figs. 329).—The purpose of this book is to describe the methods in packing employed by successful shippers. It contains, among other things, chapters on the packing of motor trucks and agricultural machinery, and describes the work of the U. S. Forest Products Laboratory at Madison, Wis., on the design of packing boxes and cases.

The design of motor trucks for high-speed service, C. O. GUERNSEY (*Jour. Soc. Automotive Engin.*, 9 (1921), No. 4, pp. 232-234).—Suggested services suited to fast trucks up to 2-ton capacity, where speed, versatility, and convenience are highly desirable, are tabulated and discussed. The seven specific requirements for a high-speed truck are enumerated, which include (1) a sustained speed capacity of from 25 to 30 miles per hour with a maximum of about 40 miles per hour, (2) ability to climb a 5-per-cent grade on high gear when carrying the rated load, (3) sufficient gear reduction and power to slip the driving wheels under any ordinary condition while carrying the rated load, (4) low operating and maintenance costs, (5) easy riding, (6) light weight, and (7) full equipment. On the basis that the gear ratio should be such that road speed will hold the engine speed within safe limits without a governor, an outline is given of the type of engine needed, its design requirements, and performance ability. Maintenance and operating costs are also considered.

The cost and utilization of power on farms where tractors are owned, H. R. TOLLEY and L. A. REYNOLDS (*U. S. Dept. Agr. Bul.* 997 (1921), pp. 61, figs. 14).—This bulletin presents the results of the first of a series of investigations which have been planned by the committee on farm power appointed by the Secretary of Agriculture to represent the Bureau of Public Roads, the Office of Farm Management and Farm Economics, and the Bureau of Animal Industry, in a cooperative study of all phases of the farm power problem. This investigation dealt with the cost and utilization of power on 286 representative farms where tractors are owned in Ohio, Indiana, and Illinois during 1920.

The average size of the farms visited was 258 acres. Two-plow tractors were owned on 174 of the 286 farms, 3-plow tractors on 104, and 4-plow tractors

on 6 farms. One farmer owned a 1-plow machine and one a 5-plow machine. Two-plow machines were found on 75 per cent of the farms with less than 160 crop acres and on 53 per cent of those with 160 or more crop acres.

One hundred and six of the tractors had been in use one year, 100 one and a half or two years, 49 two and a half or three years, and 31 had been in use more than three years. On the average each tractor was used for 30.8 full days during the year covered by the investigation. Of this period 23.5 days were devoted to drawbar work on the home farm, 2.7 days to belt work, and 4.6 days to custom work. Of the 286 tractors 73 did less than 20 days' work during the year and 26 did 50 or more days' work.

On the average each farm had 6.8 head of work stock, and their value was estimated at \$144 per head. The average number of full days' work per year per horse for all farms was 68.6. On 20 of the farms work stock did less than 40 full days' work each, and on 27 they did 100 or more days' work per year.

The tractors did 85 per cent of the plowing on these farms, 73 per cent of the disking, 43 per cent of the harrowing, rolling, planking, and packing, 41 per cent of the grain cutting, and 15 per cent of the loading and hauling of hay. On the average the 2-plow tractors saved 25 to 30 days of man labor and the 3-plow tractors 30 to 35 days required for drawbar work during the year on these farms.

The average net cost per head of keeping work stock on these farms for the year ended October 31, 1920, was \$159, and the average cost per day of horse labor for the year was \$2.43. The average first cost of the 2-plow tractors was \$972, of the 3-plow tractors \$1,354, and of all tractors \$1,140. The average amount spent for equipment, mostly plows and disks, for use with tractors was \$343. The average value of the horse-drawn implements disposed of after the purchase of the tractors was \$12.

The annual depreciation of the 2-plow tractors amounted to \$164, and of the 3-plow \$217. The annual cost of repairs was \$39 for both the 2-plow and the 3-plow sizes. The tractors were out of commission when needed on an average of about two days during the year. A little over 50 per cent were never out of commission when needed, and about one in seven were out of commission five days or more.

The fuel consumption per day for the 2-plow tractors varied from about 18 gal. for fall plowing to about 11 gal. for drawing the hay loader. For the 3-plow tractors it varied from 23 gal. for plowing to 15 gal. for drawing the hay loader. The 2-plow tractors covered 6.6 acres per day in spring plowing and the 3-plow machines 8.6 acres. The quantity of fuel required per acre was 2.7 gal. for each size.

The average cost per acre of power for the plowing done with 2-plow tractors was about \$2 and with the 3-plow about \$2.20. The cost of power for the plowing done with horses on these farms was about \$2.90 per acre. For most of the other operations the cost of power furnished by horses during the year of the investigation was slightly less than that furnished by tractors. The average cost per day of 2-plow tractors for drawbar work on the home farm was about \$12.67, and of 3-plow tractors about \$17.73. The total cost of power furnished by the tractors for drawbar work at home during the year averaged \$341.

Nine of the farms started operations with tractors. No change occurred in the size of 172 farms after the tractors were purchased, 81 were increased in size, and 24 were decreased.

On the 172 farms where no change in acreage occurred, 44 did not reduce the number of work stock, 62 disposed of one or two head, 43 disposed of three or four head, and 23 of more than four head. Of these 172 farms one horse was

kept for each 28 acres before the purchase of tractors, and at the time of the survey there was one horse for each 37.7 acres. For all the farms an average of one horse was kept for each 27.6 acres before the purchase of tractors, and there was one for each 37.9 acres at the time of the investigation.

The cultivation of corn was the operation requiring the greatest amount of horse labor in the shortest time on most of these farms. However, on only 105 of the 286 farms were all the work stock used for cultivation, and on only 38 of the remainder were they all used for any other one operation. On one-half of the farms the work stock were not all used for any one operation.

"The facts that on 20 of the farms the work stock did less than 40 days of work per head during the year and that on half of the farms they were not all used for any single operation indicate that the greatest possible use was not being made of the available power represented by the horses. . . .

"The average annual cost of power for the drawbar work on the home farm which was done with tractors was equal to the cost of keeping 2.1 head of work stock, and this is practically the average number displaced per farm. On the basis of present prices, however, the cost of keeping work stock has declined considerably more than the cost of operating tractors.

"Since, during the year covered by the investigation, the cost of power on the average farm was no greater than if it had all been furnished by horses, any saving in man-labor costs, any gain due to getting a larger amount of work done in a given time, and possibly other advantages connected with the use of tractors which can not be measured directly in dollars and cents, might be considered clear profit. On many of the farms, however, where there was no change in acreage and where no work stock was displaced, it is doubtful if such gains were great enough to balance the cost of operating the tractors."

Chilton tractor index (*Chilton Tractor Index*, 4 (1921), No. 2, pp. 436, figs. 15).—This issue of this publication contains an attempt to portray the trends in tractor design, and includes a résumé of each tractor test conducted by the University of Nebraska. A reference list of tractor books, tractors by States and per farm, and tractor production data are also included. The usual data on tractor specifications, parts, prices, etc., are given in detail.

Investigations to determine the draft of various farm implements and the cost of different operations with them, M. M. JONES (*Missouri Sta. Bul.* 189 (1921), p. 20).—It is stated that studies on the effect of disking before plowing showed that while the draft of plows is materially decreased by disking first, the total amount of work done is greater than to plow without disking in spite of the greater draft. The draft per foot of width of a single disk penetrating an average depth of 1.25 in. in silt loam corn soil was 81 lbs., and when penetrating 3 in. in silt loam soil which had been fall plowed it was 108 lbs.

Limestone spreaders (*Iowa Sta. Rpt.* 1920, p. 8).—Studies of limestone spreaders have indicated that the revolving finger type of distributor gives the most accurate calibration and uniform distribution. A homemade machine worked very satisfactorily with limestone that did not contain too much moisture. The end-gate type of machine does not spread as uniformly as the others, but will handle larger stones without breakage.

Housing farm poultry, J. B. KELLEY and J. H. MARTIN (*Ky. Agr. Col. Ext. Circ.* 107 (1921), pp. 18, figs. 8).—This circular gives information on the housing of farm poultry in Kentucky, and includes working drawings and bills of material for typical poultry houses adapted to the conditions of the State.

The Missouri poultry house, H. L. KEMPSTER (*Missouri Agr. Col. Ext. Circ.* 101 (1921), pp. 8, figs. 5).—This is a revision of Circular 93 of the station (E. S. R., 43, p. 790).

The Ohio poultry house, H. P. TWITCHELL (*Ohio Agr. Col. Ext. Bul.*, 17 (1921-22), No. 3, pp. 12, figs. 8).—Working plans and a bill of material for a 150-fowl poultry house are presented.

Handy equipment for swine raising, W. G. KAISER and J. M. EVVARD (*Iowa Sta. Circ.* 69 (1921), pp. 47, figs. 44).—Plans, construction details, bills of material, and estimates of cost for a number of items of handy and efficient equipment for swine raising are presented in this circular. These include the Iowa combination swine house, wallowing pool, and feeding floor, a concrete feeding floor, concrete dipping vat, movable fence, creep for sheep and swine, creep control, hog turn, hog hurdle, barrel hog waterer, tank hog waterer, hog waterer for pressure system, barrel pressure system hog waterer, small trough for farrowing pens, condiment box, feed mixing box, hog ringing crate, handy hog crate, hog carryall, portable hog loading chute large loading chute, alfalfa rack for swine, and an enclosed alfalfa rack for swine.

Specification of labor and materials required in building a pisé house and farm buildings of all kinds in country districts, A. MORRY (*Queensland Agr. Jour.*, 16 (1921), No. 2, pp. 70-78, fig. 1).—These specifications include working drawings showing the general features of construction in pisé.

Chimneys and fireplaces, A. M. DANIELS (*U. S. Dept. Agr., Farmers' Bul.* 1230 (1921), pp. 28, figs. 22).—A compilation of semitechnical information is here presented to aid the householder and prospective builder in the construction of chimneys and fireplaces.

Radiation calculation charts, D. N. CROSTHWAIT, JR. (*Heating and Ventilating Mag.*, 18 (1921), No. 10, pp. 27-29, fig. 1).—Formulas and charts for use in the calculation of radiation in the design of heating systems for buildings are presented and discussed.

Home storage, W. R. COLE (*Mass. Agr. Col. Ext. Leaflet* 34 (1921), pp. 7, figs. 4).—General information on the home storage of fruits and vegetables is given in this leaflet.

RURAL ECONOMICS AND SOCIOLOGY.

The farm bureau movement, O. M. KILE (*New York: Macmillan Co.*, 1921, pp. XIV+282, pls. 4, figs. 3).—As stated in the author's preface, this book is intended to reach nonagricultural groups, hoping to give them a better understanding of the background, origin, structure, and purposes of the farm bureau movement; and to present to the farm bureau members and officers a systematic study of the underlying forces and an analysis of the strength and weakness of the organization. An introduction by J. R. Howard is included.

Certain points of strength and weakness are discussed at length, emphasizing the importance of unity, able leadership, and well-paid, responsible management, as well as the danger of political alliances. The author advances a number of arguments for close alliance between the county agent system and the farm bureau organizations. Lessons to be learned from organizations of labor and commercial interests, as well as from past experiences of early and contemporary organizations in agriculture, are pointed out.

The national influence of a single farm community, E. F. HOAG (*U. S. Dept. Agr. Bul.* 984 (1921), pp. 55, pls. 14, figs. 22).—This is the story of the flow into national life of migration from a farming community surrounding the village of Belleville, Jefferson Co., N. Y., from which migration has been fairly normal and has not depleted the community.

A minute historical analysis is made of data derived from the records of 3,604 students of the farmer's community academy, an institution of high school grade located in the village, from 1824 to 1920. It was possible to trace

the residences selected by 2,445 students, of whom 17 settled outside the United States, 430 in the United States outside of New York State, 375 in the State but outside of Jefferson County, 500 in the county but outside of the larger Belleville community, and 1,123 in the larger Belleville community.

Fifteen tables are drawn up which show in detail the migration of the young people and by decades; occupations chosen by students of the academy; distribution of the stay-at-homes by townships in the Belleville community; the number of generations during which the present families in the smaller community have been living there and farming on the same farms; and marriages between the academy students connecting farm and village homes of the Belleville community.

Brief accounts are given of the careers of three students who became national figures, together with a list of many other notable persons migrating from this community, likewise of colleges from which have come teachers for the academy, and the higher institutions to which students have gone. Many of these points are illustrated by means of maps and a chart.

The point is made that not only were there strong persistent farm families rallying around the academy as a central institution, but that these strong families were knit together by the marriage by their young people who became acquainted while in attendance there. To the academy and its influence on the community is attributed the stability of the life of this community and its important contribution of notable men and women to the life of the nation.

[A report on investigations by the rural life department], O. R. JOHNSON and B. H. FRAME (*Missouri Sta. Bul.* 189 (1921), pp. 48-50).—Investigations carried on at the station are summarized as follows:

Cost of producing farm products under farm conditions.—The cost of production for the wheat and oats crops in 1920 is the same as previously noted (*E. S. R.*, 44, p. 790). The 1920 corn crop is estimated to have cost \$1.01 a bushel according to reports on 15 farms compiled for the year.

Utilization of labor on the farm.—The man and horse hours required in growing an acre of corn are tabulated according to size of fields ranging from under 10 acres to over 30 acres. Approximately 80 per cent more man labor and 40 per cent more horse labor is required on fields under 10 acres than on those of more than 30 acres.

Tractor and other farm equipment costs on the farm.—It is reported that survey records were obtained on 61 farms operating tractors for two years or more. A brief summary of the results obtained is given in tabulated form.

The balance between agriculture and industry, R. J. MCFALL (*Annalist*, 18 (1921), No. 460, pp. 438, 439, 440).—Comparative statistics from various sources are reviewed and summarized, bringing out an indication that the recent tremendous decline in agricultural prices has been mainly an effect of industrial depression throughout the world. It is said that the fall of these prices aggravated the industrial depression, and that had agricultural production declined more in harmony with conditions in industry the price declines might not have been so violent nor the depression so keen. It is considered that were it not for the fact that Russia's agricultural stagnation in some degree offsets the industrial depression of Western Europe the lack of balance would be still more serious.

Farmers' problems, H. HOOVER (*Kans. State Bd. Agr. Bien. Rpt.*, 22 (1919-20), pp. 1-18, fig. 1).—The author stresses the facts of European control of American farm prices and the restriction on free marketing of our export surplus by the scarcity of European credit, and also the retention by European nations of consolidated governmental buying, as causes contributing to the

fall in the price of wheat and other farm products. He urges cooperative action between the American farmer and banker to provide credit for European buying, also further investigation of their insurance functions, and the possibility of the extension of hedges and dealing in futures to commodities other than wheat.

The Federal farm loan system in operation, A. C. WIPRUD (*New York and London: Harper & Bros., 1921, pp. XIX+280, pl. 1, fig. 1*).—An introduction, noting briefly the comprehensive constructive possibilities in the Federal farm loan system, has been written for this volume by W. G. McAdoo. The author's discussion is arranged in chapters devoted to the framework of the farm loan system, method of financing, Federal farm loan bonds, Federal farm loans, cooperative features of the Federal farm loan system, and service aside from making loans. The appendixes occupy considerably more than one-half of this volume, setting forth provisions of the law for joint-stock land banks, the text of the Federal Farm Loan Act with index, and a bibliography relating to the subject of rural credits.

The credit association as an agency for rural short-time credit, V. N. VALGREN and E. E. ENGELBERT (*U. S. Dept. Agr., Dept. Circ. 197 (1921), pp. 24, figs. 3*).—A definition is given of a cooperative credit association, together with an illustrated description of the internal organization of such an enterprise. The status of the movement in those 10 States in which laws have been enacted is discussed, and the number, membership, and resources of credit unions are tabulated.

Notable development is said to have taken place in only 4 of these 10 States—in Massachusetts, New York, and North Carolina, where voluntary or State agencies were established for the express purpose of informing farmers and others of the law and assisting them to organize thereunder, and in Rhode Island, where the publicity work of certain private organizations is said to account for the development of credit unions. The importance of the movement in North Carolina, where there are 33 strictly rural credit unions, is attributed largely to the fact that functions of supervision and aid belong to an office of the State department of agriculture rather than to the banking department. Differences in the laws of the various States with regard to powers granted to credit unions of borrowing money, investing in shares of other unions and depositing with them, and various tax exemption features are briefly noted.

There is appended a suggestive draft of a State law for the organization and regulation of cooperative credit associations.

Size of initial payment required to permit purchase of a farm in a given time, G. STEWART (*Jour. Farm Econ., 3 (1921), No. 3, pp. 122-127*).—The present study was undertaken in areas that were included in a study previously noted (*E. S. R., 44, p. 487*). Table 1 shows the average capital, the farm income, the prevailing interest rate, the size of necessary payment, and the amount of money left from farm income if the farm were amortized in 10, 20, or 30 years at prevailing interest rates. Table 2 shows the size of initial payment that must be made at the time the farm is purchased when the family uses no money, \$300 a year, and \$600 a year, respectively, from the farm income. Table 3 shows the average percentage of the farm capital that must be advanced at the time of purchase in order to enable the operator to pay for the farm. Averages of the figures for the 26 areas without taking into account the number of farms in each area are shown in table 4.

It is apparent that men with no capital would find it difficult to purchase farms, even if they could secure all the credit needed. If the sum of \$600 be

used by the family to defray cash expenses, then 59 per cent of the farm price must be paid at the time purchased in order to permit its being amortized in 30 years from the farm income. The corresponding figures for 20 and 10 years are 63 and 75 per cent, respectively.

Land settlement, H. A. SMITH (*N. S. Wales Statis. Register, 1919-20, pt. 11, pp. 631-666*).—This continues the statistical report previously noted (*E. S. R.*, 45, p. 395).

State programs of work in farm management and farm economics (*Jour. Farm Econ.*, 3 (1921), No. 3, pp. 147-151).—These pages include brief outlines of farm management investigation and extension projects as they are being carried on in Minnesota, reported by A. Boss; in Ohio, by J. I. Falconer; in Kansas, by W. E. Grimes; and in Mississippi, by J. N. Lipscomb.

Farm management notes (for California), R. L. ADAMS (*Berkeley: Associated Students' Store, 1921, 7. ed., pp. 182*).—This is a collection of data covering agricultural statistics; methods and costs of California crop production and commercial stock industries; miscellaneous farm management data; work capacity of men, stock, implements, and machines; costs of farm equipment and supplies; and farm management outlines for reporting ranch properties, valuing agricultural lands, testing farm businesses, and studying farm management subjects. An extensive list of selected farm management literature is included.

Farm management as insurance for the northern Great Plains area, C. E. MILLER (*Jour. Farm Econ.*, 3 (1921), No. 3, pp. 113-121).—This article is the same as the address previously noted (*E. S. R.*, 44, p. 197).

What is the cost of production? S. W. MENDUM (*Hoard's Dairyman*, 62 (1921), No. 18, pp. 521, 538).—A table which accompanies this article has been drawn up on the basis of acre costs of certain Wisconsin crops as a guide to farmers wishing to work out estimates of costs and yields and other information with respect to their own operations. Suggestions are made as to the proper analysis of figures arrived at.

Labor and material requirements in the production of commercial field beans, R. S. WASHBURN (*Jour. Farm Econ.*, 3 (1921), No. 3, pp. 128-141, fig. 1).—A brief discussion is given of data derived from a study carried on in the spring of 1918 in regions representing the humid area, the Pacific Northwest, the intermountain region under both dry and irrigated conditions, and dry-land farming areas of the United States, and the great interior valleys of California, where field beans have been an important crop for many years and farm practice is well established. Estimates were obtained from 166 men as to their experiences under conditions existing during the crop year 1917. Quantitative acre requirements of field bean production are discussed under the headings of man and horse labor, manure, fertilizer, seed, and thrashing fuel. Tabulations are made by regions of each of these requirements. A summary is given, and in the last table the estimated cost of producing field beans in Genesee County, N. Y., in 1920.

Harvest labor, E. L. RHOADES (*Kans. State Bd. Agr. Bien. Rpt.*, 22 (1919-20), pp. 204-215, figs. 6).—A brief historical account is given of the wheat harvests of 1919 and 1920 in Kansas, with generalizations as to the sources of harvest labor supply, the operation of employment bureaus, and the range of harvest wages.

History of the Agricultural Wages Board (*Wages Bd. Gaz.*, 3 (1921), No. 72, pp. 258-279).—An account is given of the work of the district wages committees in ruling on hours and wages of agricultural labor in England and Wales since their establishment in December, 1917.

An outline of agriculture and agricultural labor in Japan (*Tokyo: Dept. Agr. and Com., Bur. Agr., 1921, pp. II+18*).—This report contains compiled information with regard to the area of agricultural land, rural population, systems of land holding, wages, working hours, and economic and social conditions of agricultural laborers in Japan. It is stated in conclusion that the main problem confronting Japanese agriculture is not the problem of labor but that of tenancy or the lease of agricultural land.

Status of cooperative live-stock marketing in Missouri, R. LOOMIS (*Jour. Farm Econ., 3 (1921), No. 3, pp. 142-145*).—In March, 1921, there was on file at the Missouri College of Agriculture a list of 275 organizations marketing live stock cooperatively. Of these, 129 were organized under the auspices of one association of farm clubs. Approximately 100 were organized as a result of activities of county farm bureaus, and a small number were started under grange and other auspices.

The estimated savings of 56 Missouri cooperative live-stock shipping associations in the fiscal year 1920 are tabulated. The average saving per car on all classes of stock was \$86.30.

[**Twenty-second and twenty-third annual reports of the director of the Swiss Union of Peasants, 1919 and 1920**], E. LAUR and NATER (*Pubs. Sec. Paysans Suisses Nos. 59 (1920), pp. 128; 61 (1921), pp. 120*).—These reports deal with the activities of this organization for the improvement of agriculture and outline the program of the Secretariat of Swiss Peasants, including investigations of agricultural profits, inquiries into the status of agricultural associations, and wages and hours for agricultural labor.

The Mesta, a study in Spanish economic history, 1273-1836, J. KLEIN (*Cambridge, Mass.: Harvard Univ. Press, 1920, pp. XVIII+444, pls. 5*).—The protection and control of native merino wool production and trade under early Castilian monarchs, the Catholic kings, and the Hapsburgs in the thirteenth, fourteenth, fifteenth, and sixteenth centuries in Spain is the subject of this detailed historical study. The history of the rise to power and privilege and the downfall of the Honorable Assembly of the Mesta of Shepherds, the Castilian sheep raisers' guild, furnishes the key to the economic policy underlying this period of Spanish national development, since this body became the instrument with which Spanish sovereigns increased their own revenues and worked for national economic advantage.

The archives of this institution and numerous other documentary sources have been searched, and the chronicle is presented here in parts dealing respectively with organization, judiciary, taxation, and pasturage.

Certain disastrous effects on agriculture and rural conditions of the exclusive development of the migratory sheep industry are pointed out.

The Market Reporter (*U. S. Dept. Agr., Market Rptr., 4 (1921), Nos. 21, pp. 321-336; 22, pp. 337-352, fig. 1; 23, pp. 353-368*).—The usual current market information is offered in these numbers in special articles and tabulations of market statistics dealing with live stock and meats, dairy and poultry, fruits and vegetables, grain, hay and feed, seeds, and cotton. Generally declining prices are noted, although some strength is indicated in the last issue, covering reports for the week ended November 26, in cattle, wheat, butter, and cotton prices. Special articles are included on the commercial vegetable seed production in 1921 (No. 21), the season's tomato shipments, and world wool stocks (No. 23). Other summaries appear for shorter periods.

Farmers' Market Bulletin (*North Carolina Sta., Farmers' Market Bul., 8 (1921), No. 46, pp. 8*).—With this issue there is resumed the publication of the partial list of products which farmers have for sale previously noted (E. S. R.,

45, p. 493). A report is made on the progress of a campaign for membership in a tri-State tobacco marketing organization.

Accounting records for sampling apples by weight, J. H. CONN and A. V. SWARTHOUT (*U. S. Dept. Agr. Bul. 1006 (1921), pp. 13, fig. 1*).—Five new accounting forms have been devised for use in packing houses sampling fruit by weight. These forms are intended to take the place of those described in Bulletin 590 (*E. S. R., 38, p. 793*). They are described and sample copies are reproduced. A method of operation for community packing houses of this type is outlined. A suggested condensed operating schedule follows. Finally there is drawn up a table of the reciprocals of the percentage of test from 2 to 5 per cent (extended to two decimal places), used as multipliers in determining the total weight of the load classified as to grades and sizes.

Cotton and wool, J. S. M. WARD (*London: William Rider & Son, Ltd., 1921, pp. 270, pls. 3*).—Cotton production in the British Empire and in other countries is summarized, certain manufacturing processes are described, and a brief digest of statistics of past and recent prices and supplies of cotton is included, together with an extensive bibliography arranged chronologically, 1881 to 1920.

The wool resources of the British Empire and other areas are similarly described. Exports, imports, and prices are summarized and a bibliography is given.

The world's wheat, J. WILSON (*Jour. Roy. Statis. Soc., n. ser., 84 (1921), No. 3, pp. 329-391*).—These pages embody a paper giving a brief description of methods of crop reporting, collection of statistics of exports and imports, and the making of forecasts and final estimates, approved by the International Institute of Agriculture, together with a discussion of statistics of wheat production, trade, and consumption in important countries of the world through periods of years. Considerable discussion is contributed by R. H. Rew, Lord Bledisloe, and others.

The yields of Irish tillage food crops since the year 1847 (*Ireland Dept. Agr. and Tech. Instr. Jour., 21 (1921), Nos. 2, pp. 205-229, figs. 8; 3, pp. 289-305, figs. 6*).—This article deals in general terms with the fluctuations in the yield of Irish tillage food crops since 1847, graphically illustrated, and more specifically with certain of the factors affecting such yields, including soil fertility; the quantity and quality of the fertilizers applied; use of machinery and intensity of cultivation; weather conditions; social, economic, and legislative changes; agricultural pests; seed selection; and development of agricultural knowledge.

Lanao: Its natural resources and opportunities for development, P. J. WESTER (*Philippine Agr. Rev., 13 (1920), No. 4, pp. 252-264, pls. 6*).—This article gives a general description of this Province in the Philippines and of the agricultural industry carried on there.

Bukidnon: Its natural resources and opportunities for development, P. J. WESTER (*Philippine Agr. Rev., 13 (1920), No. 4, pp. 237-251, pls. 8*).—This article, similar to the above, is descriptive of an inland Province in the Philippines.

[Cattle raising and agriculture in Colombia], P. L. BELL (*U. S. Dept. Com., Bur. Foreign and Dom. Com., Spec. Agents Ser., No. 206 (1921), pp. 138-179, pls. 2*).—Conditions and general characteristics of these industries, the markets, and the possibility of development are subjects under review in these chapters of a commercial and industrial report. Cacao, rice, tobacco, and coffee raising are discussed in detail.

Agricultural statistics of Uruguay, S. S. RODRÍGUEZ (*An. Estadís. Agr. [Uruguay]*, 1919-20, pp. LIII+327).—The report on agricultural production for the year 1919-20 continues information previously noted (E. S. R., 44, p. 192).

Agricultural statistics of France [*Ann. Statis. [France]*, 36 (1919-1920), pp. 50-54].—These tables, showing area sown and yields of principal crops and numbers of live stock in France and in foreign countries for periods of years up to and including 1920, continue a series previously noted (E. S. R., 41 p. 893).

Agricultural statistics of Switzerland [*Statis Jahrb. Schweiz*, 28 (1919), pp. 83-110].—Tabulated statistics continue information in the series previously noted (E. S. R., 45, p. 695).

AGRICULTURAL EDUCATION.

History and development of the Ontario Agricultural College, C. A. ZAVITZ (*Sci. Agr.*, 1 (1921), No. 3, pp. 101-105, figs. 5).—A brief historical account is given.

Fifth administrative report of the higher school of agronomy of Bogota, C. DENEUMOSTIER (*Mem. [Colombia] Min. Agr. y Com. Cong. 1921*, pp. 29-67).—This report is submitted in two parts, the first showing progress during the school year of 1919; the second, statistics of courses offered, number of students, and classes held.

Agricultural education in the schools, SILIÓ (*Prog. Agr. y Pecuario*, 27 (1921), Nos. 1223, pp. 714, 715; 1224, pp. 730, 731).—Rules are given as laid down by the Spanish Ministry of Public Education and Fine Arts for the conduct of agricultural experimental plats annexed to the schools for the purpose of giving practical instruction in the use of fertilizers, seed selection, crop rotation, use of machinery, protection against plant pests and diseases, and other improved agricultural practices.

Features of the practical agricultural education planned for the Belgian Kongo, LEPLAE (*Cong. Agr. Colon. [Paris]*, 1918, *Compt. Rend. Trav.*, vol. 1, pp. 318, 319).—Plans for agricultural education for native boys and girls in the Belgian Kongo include practical elementary schools with the cultivation by students of small plats exclusively for their own profit and experience.

The value of school supervision, M. S. PITTMAN (*Baltimore: Warwick & York, Inc.*, 1921, pp. X+130).—The investigation discussed in this dissertation was undertaken to determine the effect of supervision upon the work of rural schools when the supervision is done according to the zone plan, under which the supervisor divides his entire supervisory districts into territorial units, each of which sets the limitation for one week of supervisory effort.

The standings of the children in 13 school functions were determined about October 1, 1919, for two groups—the experimental and the control. This was followed by seven months of supervision of the school work of the former and the standings of the two were again determined in May, 1920.

A study of the equivalence of the two groups indicated that differences of nationality and educational equipment of the people, their social and commercial opportunities, and percentages of landowners and renters were small. The experimental group was superior in the certification and salary of the teacher. The control group had the advantage of a higher percentage of two-teacher schools and a higher percentage of its pupils in two-teacher schools. The control group had more taxable property for the support of each child and a slightly longer school term. The teachers of this group had more academic equipment and more experience.

The zone plan of supervision implies a calendar of events for the year's work, the major ones consisting of supervisory tours and teachers' meetings. Group teachers' meetings were held at which the supervisor taught a demonstration lesson in the subject which would be under special investigation during the months immediately following. Three weeks later the supervisor visited this school, heard several recitations, conferred with the teacher, and visited the people of the community.

Tables 1 to 22 embody statistical data derived from the tests given to the pupils in both the experimental and the control groups. The results are summarized as follows:

(1) Out of 76 average improvement scores the experimental group was superior in 67; (2) out of a total of 51.67 experimental coefficient points, the total measures showing the degree of reliability that the differences indicated are properly placed, 48.62 points favor the experimental group; (3) the median progress of the experimental group, when expressed in terms of the progress of the control group, was 193.75 per cent; (4) by the equated difference method it is shown that it would take the control group 0.942 of a year to reach the same point of improvement attained by the experimental group; (5) the average number of children for each grade who improved in all functions combined was greater for each of the six grades in the experimental group than for the corresponding grade of the control group; and (6) the average number of children of all grades combined who improved in each function was greater for the experimental group than for the control group in 12 out of 13 functions.

Other results of supervision not shown by standardized tests are discussed.

Methods of teaching vocational agriculture in secondary schools, S. H. DADISMAN (*Boston: Richard G. Badger, 1921, pp. 142, pls. 15*).—This is a guide for use in training teachers of agriculture in accordance with provisions of the State and National vocational education acts. A brief history of agricultural education is given, and the operation of the Smith-Hughes Act is outlined. A pedagogical description of the project method and illustrative lesson plans are offered, together with certain suggestions as to field and laboratory work. The content of each of the four year's high school courses in agriculture and that of a farm mechanics course are outlined. Concluding chapters set forth the agricultural teacher's relations to cooperative rural organizations and to the community. A brief bibliography is included.

Home demonstration work, O. B. MARTIN (*Jour. Home Econ., 13 (1921), No. 9, pp. 408-412*).—This paper, presented before the fourteenth annual meeting of the American Home Economics Association, June 30, 1921, sets forth the contributions made to American education by home demonstration work.

Status and results of boys' and girls' club work, Northern and Western States, 1920, G. E. FARRELL (*U. S. Dept. Agr., Dept. Circ. 192 (1921), pp. 36, figs. 10*).—The development of over 3,000 common community programs of work for men, women, and boys and girls is noted, and also the fact that county club agents carried on more than one-third of all club work reported in 1920. It is noted that the value of club work as an extension enterprise lies in the concentration of effort over many rather than over a few boys and girls, and that the cost per capita is thus considerably decreased. It is shown how economic conditions, especially war needs and market situations, have affected the enrollment in club work and cause a demand for flexible club programs. Summaries are given of some demonstration results and outstanding features of home-making activities in 1920. Numerical reports on members enrolled and results of dairy, swine, sheep, baby beef, poultry, garden, corn, and potato demonstrations are submitted.

MISCELLANEOUS.

Annual Report of Iowa Station, 1920, C. F. CURTISS and W. H. STEVENSON (*Iowa Sta. Rpt. 1920*, pp. 64).—This contains the organization list and a report on the work of the station, including a financial statement for the fiscal year ended June 30, 1920. The experimental work recorded is for the most part abstracted elsewhere in this issue.

One year's work [at the Missouri Station], July 1, 1920, to June 30, 1921, F. B. MUMFORD ET AL. (*Missouri Sta. Bul. 189 (1921)*, pp. 64, figs. 16).—This contains the organization list, a report by the director on the work and publications of the station, and a financial statement for the Federal funds for the year ended June 30, 1921. The experimental work reported is for the most part abstracted elsewhere in this issue.

Twenty-seventh Annual Report of Montana Station, 1920, F. B. LINFIELD ET AL. (*Montana Sta. Rpt. 1920*, pp. 52).—This contains the organization list, a financial statement for the fiscal year ended June 30, 1920, and a report of the director and heads of departments on the work and publications of the station. The experimental work reported is for the most part abstracted elsewhere in this issue.

Report of the New Hampshire Station for 1919 and 1920 (*New Hampshire Sta. Bul. 198 (1921)*, pp. 22).—This contains the organization list, a report on the work and publications of the station, and a financial statement for the fiscal years ended June 30, 1919, and June 30, 1920. The experimental work reported is for the most part abstracted elsewhere in this issue.

Thirty-first Annual Report of New Mexico Station, 1920, F. GARCIA (*New Mexico Sta. Rpt. 1920*, pp. 53, figs. 9).—This contains the organization list, a report of the director on the work and publications of the station, and a financial statement for the year ended June 30, 1920. The experimental work reported is for the most part abstracted elsewhere in this issue.

Thirty-third Annual Report of Texas Station, 1920, B. YOUNGBLOOD (*Texas Sta. Rpt. 1920*, pp. 80, figs. 35).—This contains a report of the director on the work of the station and the various substations, and a financial statement for the Federal funds for the fiscal year ended June 30, 1920, and for various State funds for the fiscal year ended August 31, 1920. The experimental work reported is for the most part abstracted elsewhere in this issue.

Miscellaneous notes, E. H. JENKINS (*Connecticut State Sta. Bul. 231 (1921)*, pp. 351-356).—These pages include several articles abstracted elsewhere in this issue, and a brief note entitled Certification of Babcock Test Apparatus.

Digging up facts for New Hampshire farms, J. C. KENDALL (*New Hampshire Sta. Bul. 199 (1921)*, pp. 30, figs. 19).—This is a brief survey of some of the research work conducted at the station, including summaries of some of the results secured.

Monthly Bulletin of the Ohio Experiment Station (*Ohio Sta. Mo. Bul.*, 6 (1921), Nos. 7-8, pp. 97-128, figs. 7; 9-10, pp. 129-159, figs. 9).—These numbers contain, in addition to several articles abstracted elsewhere in this issue and miscellaneous notes, the following:

No. 7-8. Standardization of Wheat Varieties, by M. K. Corbould.

No. 9-10. Methods of Renting Land, by J. I. Falconer, an abstract of the bulletin previously noted (*E. S. R.*, 45, p. 693); Crop Rotations for a Dairy Farm, by C. W. Montgomery; and Answers to Timely Questions.

NOTES.

Arizona University.—Robert Penquite has been appointed instructor in poultry husbandry and will divide his time between instruction in the college and extension work.

Connecticut Stations.—A Tree Protection Institute was held at the State Station on February 21. The program included a report on the work of the State Tree Protection Examining Board; a demonstration on modern methods of tree surgery; and addresses dealing with the growth of trees, the pruning and spraying of fruit trees, the effects of smoke, gases, electricity, and oil injury, pruning and cavity work as applied to shade trees, and some common insect pests of shade trees.

The State Station is to issue reports and bulletins of its new tobacco substation in a separate series from the regular publications, confining the distribution primarily to tobacco growers in the Connecticut and Housatonic Valleys.

The death in February is noted of W. H. Hall, a member of the board of control of the Storrs Station.

Kansas College.—Plans are being completed for the first of a series of dormitories for women students. An appropriation for \$112,500 is available for this building, which will house 75 students.

Kentucky Station.—R. H. Ridgell, chemist, and H. R. Niswonger, field agent in horticulture, have resigned.

Louisiana Stations.—A substation has been established at Hammond for the purpose of studying varieties of fruits, berries, pecans, and truck crops adapted to cultivation in that section and the diseases affecting them. Tangipahoa Parish, in which the substation is located, has given 190 acres of land for its use and provided \$18,000 to carry on its investigations, which will be under the supervision of the main station at Baton Rouge. Boleslaus Szymoniak, formerly horticulturist with the U. S. Department of Agriculture and later connected with the university, will be in charge of the work.

Massachusetts College and Station.—A State appropriation of \$300,000 for a new chemical laboratory has been approved by the governor, and construction is to be begun at once. This will replace the wooden structure erected in 1867 as the first building on the campus, and will provide badly needed facilities for the chemical work of the college and station.

The new building will be 195 by 56 feet, with two wings extending to the rear. The construction is to be of brick with steel and cement floorings and fireproof throughout.

The building will be largely devoted to laboratories and lecture rooms with an auditorium on the first floor seating 212 people. Quarters for the chemical work of the station are to be located on the second floor, and will include six laboratories with accommodations for at least 10 chemists.

This floor will also contain the chemical library, including the Goessmann alcove housing the library of the late Dr. Goessmann.

The station now receives an appropriation for maintenance of \$83,300, approximately the same as for the previous year. This is exclusive of all control operations, which provide an additional \$26,600, and does not include certain overhead costs, such as light, heat, and building maintenance. For equipment the legislature has appropriated \$15,000 for the purchase of additional land, and \$5,000 for extensions to the experimental poultry plant.

The State appropriation for instruction is \$501,875, and for the extension service \$87,290.

Minnesota University and Station.—Dr. M. J. Dorsey, for 10 years in charge of the section of fruit breeding of the department of horticulture, has been appointed head of the department of horticulture at the West Virginia University and Station, vice J. H. Gourley, whose resignation has been previously noted. C. G. Worsham, instructor in agronomy and farm management, resigned December 31, 1921, to become associate farm economist in the South Dakota Station and extension service. W. A. McKerrow, for 10 years connected with the extension division in live stock and dairying work, died January 5, aged 39 years. W. H. Peters has been appointed chief of the division of animal husbandry.

Mississippi Station.—Dr. H. B. Brown has resigned as plant breeder and vice director to engage in commercial seed breeding at Weilenman, but will retain his connection with the station as collaborator, particularly along the lines of cotton breeding. J. F. O'Kelly has been appointed associate agronomist.

Nebraska Station.—Dr. Morris J. Blish, assistant chemist of the Montana Station, has been appointed agricultural chemist, and entered upon his new duties March 1.

Nevada Station.—A cooperative arrangement between the California and Nevada Stations has been arranged whereby Dr. Henry Severin of the California Station will extend his studies of the sugar beet leafhopper, *Eutettix tenella*, in Nevada.

Tests of rabbit brush, *Tetradymia glabrata*, a common shrub on the sheep ranges of the Great Basin, have shown that its poisonous property is cumulative. If small lots are fed daily, enough of the poison is retained in the animal's system to cause a toxic effect after a few days have elapsed.

Rutgers College.—Mrs. Helen M. App resigned as State leader of home demonstration work February 1, and has been succeeded by Miss Marion Butters, home demonstration agent for Morris County.

Cornell University and Station.—C. B. Hutchison, professor of plant breeding, has resigned to succeed H. E. Van Norman as dean of the University Farm School of the University of California at Davis, effective March 1. Leslie E. Card, instructor in poultry husbandry and assistant animal husbandman, has resigned to assume charge of the newly organized poultry department of the University of Illinois. George H. Rea, extension entomologist, has accepted a corresponding position at the Pennsylvania College.

Ohio State University and Station.—F. W. Ives, head of the department of agricultural engineering, has also been designated farm architect for the university, and will thus be given charge of plans for the new agricultural buildings of the institution, including the horse barn, beef cattle barn, and dairy barn which are soon to be erected.

A course in agricultural journalism has been introduced into the curriculum, and will be given by Lester C. Getzloe, formerly director of journalism courses in the Oklahoma College and recently appointed assistant professor of journalism. C. L. Metcalf, head of the department of entomology, has been appointed head of the department of entomology in the University of Illinois.

Donald S. Bell has been appointed assistant in the animal industry department, effective March 1, and will devote his time largely to experimental work in sheep production. F. A. Derthick, a former member of the station board of control, died at Mantua January 4.

The woodlands on the Washington and Hamilton County Experiment Farms are being cleaned up by removing worthless trees and inferior species from the parts which are to be retained as permanent wood lots. An acre or more on the former farm has been cleared for pasture, and the timber thus obtained will be used for fence posts and tomato stakes.

C. H. Wilson resigned January 1 as manager of the Belmont County Experiment Farm to engage in commercial work. Paul Fisher has been appointed acting foreman of the farm.

Pennsylvania Station.—Approximately 10,000 acres were seeded in Pennsylvania last fall to a new variety of wheat which was originated from a single head selected at the station in 1909. This wheat has been designated Pennsylvania 44, and is a selection of Fulcaster. It represents practically the only survivor of nearly 1,200 selections made at the station from 1908 to 1917.

Like Fulcaster, the new wheat has red grains, white chaff, purple straw, and is bearded. It is a few inches taller than Fulcaster and is usually 2 or 3 days later in ripening. It has stiffer straw and when grown on rich soil its ability to stand up has been quite noticeable.

Observations as to rust resistance by the Office of Cereal Investigations, U. S. Department of Agriculture, at Madison, Wis., La Fayette, Ind., and Knoxville, Tenn., have indicated that this variety is as resistant as any of the soft winter sorts and much more resistant than most, though less resistant than Crimean wheats, such as Turkey and Kanred. At State College it suffered as little from rust as any variety in 1921, when there was a severe outbreak of the disease.

The average yield per acre for the 8 years, 1914–1920, at the station has been 35 bushels, as compared with 32.6 bushels for Dawson Golden Chaff, 31.1 bushels for Harvest King, 30.9 bushels for China, 29.4 for Fulcaster, etc. In 46 tests by farmers from 1919 to 1921, increased yields have been obtained averaging from 5 to 6 bushels per acre. Milling and baking tests indicated that its bread making quality was practically that of Fulcaster.

Virginia Station.—The State Legislature has appropriated \$50,925 for the fiscal year ending February 28, 1923, and \$52,925 for the following fiscal year. These amounts represent increases of 70 and 76 per cent, respectively, over the appropriations for the two preceding years.

Repairs and improvements have been completed on the barn for the station dairy herd, providing convenient and modern facilities for handling the project on feeding dairy cows.

The station is beginning a project on apple scab and its control. This disease causes heavy losses to fruit growers in Virginia every year, and spraying recommendations which are based largely on experiments conducted in other States have not proved effective, possibly because of weather conditions. F. J. Schneiderhan has been appointed assistant plant pathologist to study this problem, and will be located at the field laboratory to be established at Winchester.

Staff Changes in Canadian Institutions.—Dr. Charles E. Saunders, Dominion cerealist since 1903, has resigned. Dr. M. O. Malte, Dominion agrostologist at the Central Experimental Farm, has been appointed chief botanist of the Canadian National Herbarium at Ottawa. E. H. Strickland of the Dominion Entomological Branch has been appointed professor of entomology at the University of Alberta. George E. Sanders, entomologist in charge of insecticide investigations in the Dominion Department of Agriculture, has resigned to

accept a commercial position in Louisville, Ky. J. Sydney Dash has been appointed supervising seed analyst in the seed branch of the department.

Western Ontario Experimental Farm.—A tract of 190 acres in southwestern Ontario has recently been purchased by the Provincial Government at a cost of \$205 per acre. This farm is located near Ridgetown in Kent County, and possession was obtained March 1. The tract will be developed as an experimental farm for the culture and curing of tobacco for export, experiments on farm fertilization, the production of seed corn, and the treatment of fungus diseases, particularly of beans. R. W. Reek, assistant to the Dominion live stock commissioner, has been appointed in charge of the farm.

Philippine College of Agriculture.—The College of Agriculture of the University of the Philippines has been given \$2,000 by the Hawaiian Sugar Planters' Association toward the erection of an insectary.

Frank P. McWhorter has been appointed associate professor of plant physiology and has entered upon his duties.

British National Institute of Agricultural Botany.—Headquarters buildings for this institute, located at Cambridge, have recently been completed, the formal opening taking place on October 7, 1921. The institute is modeled on the general lines of the Svalof organization in Sweden, and includes a crop improvement branch, the official seed testing station of England and Wales, claimed to be the largest and best planned in the world, and the potato testing station.

A tract of 30 acres of land which surrounds the buildings is being used for testing purposes. The institute also owns a 334-acre farm, given by Fred Hiam at St. Ives, Huntingdon, available for large scale crop improvement work, and 39 acres at Ormskirk, Lancashire, the latter tract being used as a potato testing station.

An informal visit was paid the institute on October 14 by the King and Queen; the Minister of Agriculture, Sir Arthur Griffith Boscawen; and others, their Majesties each planting a mulberry tree on the grounds.

The institute was constituted as a charitable trust, large contributions being received from Sir Robert McAlpine & Sons, Viscount Elveden, members of the agricultural seed trade, the milling industry, and other agricultural trades of the United Kingdom, as well as the gift of the St. Ives farm already referred to. A grant for maintenance on the pound for pound basis is being made from the Development Fund.

Gift of Large Estate to British Government.—Lord Lee, First Lord of the Admiralty and former Minister of Agriculture, has presented to the British Government an estate of 1,300 acres, for maintenance primarily as a model stock raising farm. About 700 acres is farm land, the remainder woodland. It is hoped to utilize the farm in demonstrations of the growth and value of improved varieties of cereals and fodder crops and the improvement of grassland in connection with the intensive breeding and rearing of live stock, and at the same time to maintain it along the lines applicable in ordinary farm practice. *Nature* concludes its account of the gift as follows:

"It is a hopeful augury, and one not without significance, that future prime ministers should be able to see at their doors an example of agricultural education in being. Lord Lee's munificent donation adds to the debt of gratitude which the Nation already owes him, and gives the agricultural authorities an opportunity of carrying out work which has long been needed, and which they have long desired to do."

Southern Forestry Experiment Station.—This station has been recently organized by the Forest Service of the U. S. Department of Agriculture, with

headquarters for the present at New Orleans, La. Experiments are to be conducted in the large and important timber region extending from eastern Texas through Louisiana, Arkansas, Mississippi, Alabama, Georgia, and Florida to the Carolinas. The funds at the disposal of the station are not sufficient to permit of the construction of buildings and laboratory facilities, and for the first year attention will be concentrated on field work in the most urgent problems.

R. D. Forbes, formerly superintendent of forestry for the conservation commission of Louisiana, has accepted the directorship of the station, with Lenthall Wyman, W. R. Hine, and a third member to be appointed, to constitute the technical staff.

New Forestry Building at Yale Forestry School.—A new forestry building has been provided for the Yale Forestry School at a cost of \$300,000, as a gift from William H. Sage of Albany, N. Y., an alumnus of the class of 1865. The building is three stories high on the north front and four stories on the south.

The ground floor will house a laboratory for testing work and quarters for the Forest Club, these being distinctively fitted up with panels contributed by the New York Lumber Trade Association and constructed of a great variety of woods. The first floor will contain the departmental library, administration offices, and an assembly room seating about 150 people. On the second floor will be classrooms, a drafting room, and a silvicultural laboratory, while the top floor will be devoted to the main laboratory, a herbarium for wood collections, and special rooms for research.

Agricultural Education at the U. S. Veterans Bureau Vocational Schools.—Announcement has recently been made by the U. S. Veterans Bureau of the practical completion of plans for the opening of the agricultural section of Vocational School No. 1, at Camp Sherman, Chillicothe, Ohio. A corps of six instructors and four assistants has been secured and facilities provided for about 50 students, with opportunity for an additional number later. Buildings are available for conversion into classrooms, laboratories, dairy barns, and other equipment, together with ample farm lands for instructional purposes. Dormitory facilities will be available for 400 students, and also numerous one-story buildings convertible into homes for families of trainees.

Courses are contemplated in agronomy, economic entomology and botany, animal husbandry, dairying, horticulture, farm mechanics, and farm management, with related training in English, history, arithmetic, geography, drafting, and current events. Training in forestry is also intended, and the State of Ohio has appropriated \$10,000 for a forest nursery and reforestation work to be located at or near Camp Sherman.

The institution is intended for training disabled soldiers of limited general education, and the training is to be primarily practical with a view to preparing men to engage in farming and related lines. Certificates somewhat comparable to those issued by other institutions for two-year non-collegiate courses will be granted on completion of the work.

West Indian Agricultural College.—A site at St. Joseph for this institution has been presented by the Government of Trinidad, and plans have been submitted for buildings, although it is expected that construction will be carried on rather conservatively. As soon as the necessary housing accommodations have been completed, it is planned to transfer the Imperial Department of Agriculture from Barbados, probably by the close of 1922.

The college has been formally incorporated, and a governing board was selected some time ago. Sir Arthur Shipley has been appointed chairman

of the board and Sir David Prain, formerly director of the Royal Botanic Gardens at Kew, vice chairman. Sir Francis Watts has been appointed principal of the college.

Provision is made in the charter for instruction in the principles of agriculture and in the cultivation and preparation for the market of tropical produce of every kind, including sugar and its by-products, rum and molasses, cacao, coffee, cotton, coconuts, rice, citrus and other fruits, dyewoods, and all vegetable, mineral, and maritime products of the British West Indies, including British Guiana and British Honduras. Authority is specially conferred to "make full provision for the prosecution of research and for the training of scientific investigators in matters pertaining to tropical agriculture amid suitable surroundings, and for creating a body of British expert agriculturists, well versed in the knowledge of the cultivation of land in the Tropics, of chemists, mineralogists, and of scientific advisers possessing an intimate knowledge of the means of combating pests and diseases."

World's Dairy Congress.—The general plan for holding this congress was decided upon at a conference of the executive committee and board of vice presidents with Secretary Wallace of the U. S. Department of Agriculture and representatives of the Departments of Agriculture, State, and Commerce, March 13. The congress is to be held in this country in October, 1923, during the week preceding the National Dairy Show, at a place not yet selected.

The program is to be arranged under departments of education and research, industry and economics, regulation and control, and public health. The department of education and research will seek to promote the exchange of the scientific knowledge underlying the development of the dairy industry. The department of industry and economics will concern itself with the readjustment of business conditions through making clear the world movements of dairy products, dairy cattle, dairy machinery, and by the study of the forces that determine market prices. The department of regulation and control will study the problems arising in that field, the health of cities and nutrition of children. The department of public health will be concerned with arousing a wider appreciation of vitamins to be found in milk and milk products.

Appointment of the program committee and subcommittees is expected to be announced shortly.

Necrology.—Dr. John P. Stewart, associated with horticultural investigations at the Pennsylvania Station from 1907 to 1918, died suddenly at his home at York, Pa., on January 21, at the age of 45 years. Dr. Stewart was born in Illinois, and graduated from the State university in 1902, later receiving the degrees of M. S. A. and Ph. D. at Cornell University. His studies at the Pennsylvania Station on the fertilization of apple orchards and on the preparation and use of lime-sulphur had attracted wide attention among horticultural investigators. At the time of his death he was engaged in private and advisory work and was also serving as horticultural editor for the *Pennsylvania Farmer*. He was a member of several scientific societies, and a fellow of the American Association for the Advancement of Science.

Frits Robert Böhlingk, sugar technologist in the Java Sugar Experiment Station since 1914 and the author of numerous articles on sugar mill construction and operation, died January 23 at the age of 39 years.

EXPERIMENT STATION RECORD.

VOL. 46.

APRIL, 1922.

No. 5.

From time to time reference is heard to the matter of duplication in experiment-station work. The inference is that there continues to be a considerable amount of repetition by different stations which is unnecessary and uncalled for by the present status of information. Judging from the source of such criticism the more practical and economic lines of experimentation are presumably in mind rather than the intensive inquiry, although the latter may be included along with the other.

Such a charge is not new and is not necessarily to be taken as unfriendly criticism. On the contrary, it evidences an interest in the work of the stations and a desire for the utmost in results. This is favorable, of course, as well as the implied special interest in the securing of results which are new and which represent an advance in ideas. So far as such a suggestion is well founded it is entitled to consideration, and if it proceeds from misunderstanding based on a somewhat superficial knowledge of what is actually being done or is necessary to thoroughness and accuracy, as may be the case, it deserves to be fairly met. This is especially true at this time when the pressure for funds is circumscribing the stations in their activities and preventing their doing all they realize to be necessary.

The claim of too much repetition is usually of a general and indefinite character, rather than applied to specific subjects or cases. The source of the idea is not altogether clear. It may involve a misapprehension of present-day work, or it may go back to the time when the stations were called upon to act more largely as disseminators of information. Prior to the separate organization of the extension work, the stations were called upon for much which would now be regarded as in the field of demonstration and extension work, with the preparation of popular articles of general interest for local use. This gave similarity to these popular write-ups, and they were often assumed to represent work of the issuing stations. Where some experimental work was incorporated along with the general information, the manner of presentation often made it difficult to recognize it in the bulk of the material. As the subjects treated covered much the same general range, such a series of publications might convey the

impression that many stations were concerning themselves with practically the same line of experiments and were going over the ground in much the same way.

However that may have been, the situation at the present time is quite different. There has been much progress in restricting the field of the stations to experiment and investigation, and the project system has served to set forth their efforts more definitely, as well as to secure larger consideration of the working program as a whole. Furthermore, the agitation for a larger measure of cooperation or co-ordination has had its effect. And beyond this, the fact that many of the simpler questions of agricultural practice have been worked out, and a broad background of general information supplied in relation to other subjects, has relieved the pressure for local repetition and been accompanied by steady advancement of experiment station ideals.

In a word, the sentiment within the stations for work along advanced lines and the support for it on the part of the public has marked a very material change. The question may be asked, therefore, whether as a matter of fact there is as much following along conventional lines as there was earlier, with extensive duplication of experiments of the same general character in different States, or whether, on the contrary, there is not an increasingly conspicuous amount of originality and specialization in the work of the different stations.

What may appear to the superficial observer to be an endless repetition may not prove to be so when the circumstances are known, or if true it may be quite justified. The history of station work has taught caution in reaching practical conclusions, and especially in applying them to a remote locality. Before transplanting such findings assurance will be desired both of their applicability and practicability under the new environment. Agricultural investigation deals to only a limited extent with absolute values. It determines things which are general and permanent and represent underlying principles, but to a considerable degree its practical findings are comparative, and are contingent on a variety of factors which go to make up the complex of agricultural conditions. Many of these factors are variable with the season or the soil or type of farming, so that a certain amount of verification is inevitable.

Furthermore, the stations are not only concerned with the search for new truths but the larger and better use of truths and facts already known. This requires experiments of a kind which may be viewed as repetition but are in fact quite essential to the safe propagation of knowledge. Again, the results of research need to be restudied from time to time in the light of the progress of

science or of changed conditions which affect their relationships. This is true at the present time of some of the leading subjects in agriculture. The earlier conclusions and deductions need to be tested in the light of investigation which has penetrated more deeply, in order to correct possible error and to make further advances.

So that a considerable amount of work on the same subjects by different stations is not only desirable but essential. The point is to recognize where the necessity exists and guard against the superfluous. Repetition with no deeper or more far-reaching purpose than imitation after verification has been abundant, without closer observation or the incorporation of a new viewpoint or method, deserves disapproval. It should be an anachronism at the present time. And if experimentation does not take full account of what others have learned or think they have learned it is deficient, and it may lay its author open to just criticism.

The same is true of all types of investigation. Unless the spirit of inquiry is active a point may be reached where the multiplying of observations or experiments does not contribute new information or further clarify a fact, but may lead the worker close to the border line of extension, if indeed, he does not overstep it.

Knowledge of scientific facts does not grow merely by repetition of observation and experiments. It grows by injecting something new into the search or an element of inquiry into the study of results. These serve to make the purpose a worthy one and give life and virility to the undertaking. After the preliminary steps in a line of investigation, experiments are not made to see what will happen. Conditions are prescribed and the plan is constructed to accomplish a purpose in the best conceivable way. This is the case whether the work is elementary or more fundamental. Duplication which merely discloses something new to the worker himself is evidently without warrant, because he should have mastered what is known about a subject before he entered upon it. The purpose of further experiments is to strengthen what is known and if possible to add to it. Some element of novelty or originality may be presupposed in all new station work entered upon at this stage.

It follows that the planning of an experiment or an investigation is a matter for careful consideration at the outset. It is one of the advantages of the project system that it encourages the study of the subject and the development through such study of the point of attack and the plan of procedure—the suggestion of a new idea or means. In the past such consideration was not always given. Often the plans were quite indefinite and were developed as the work went on, frequently resulting in lost motion and ineffective effort. There are sometimes evidences even now that the planning of certain classes of

work is not done deliberately, taking account of what is known and what it is desired to develop further, and there are evidences of hasty scrutiny from those charged with administration.

Manifestly the details of research must be left primarily to the individual worker, and he must be given freedom of opportunity. Anything like censorship of research and original experimentation is clearly to be avoided. This should be the case in fact, and equally there should be an absence of apparent need for it. But whether this type or that type of investigation is to be pursued, and whether elementary work is to be gone over repeatedly without material change, are matters of policy within the determination of the administrative officer.

To avoid misunderstanding on the part of the public it may be desirable for stations to make clear the purpose or distinguishing characters of their investigations, and the manner in which they are designed to add to what has been found elsewhere; and above all, to make it evident in all lines of station work that progress is the watchword and is being expressed in the character of the effort.

The impression of what the stations are doing is gained by the public largely through their publications and the outlines of their programs. To determine what ground if any the former might give for a claim of needless duplication, an examination was made of the station publications for the calendar years 1920 and 1921. These were found to cover a very wide range of subjects and to represent a rather surprising amount of individuality on the part of different stations. Even judging by the titles alone, there is little to suggest duplication which is questionable or open to objection; and where titles are similar there is much diversity in the nature of the work.

The list for these two years includes 108 reports, 245 circulars, and 847 regular and technical bulletins, a total of 1,200 separate publications received by the Office of Experiment Stations within these dates. Of the bulletins and circulars, 115 related to inspection or regulatory work of various kinds; 46 to general service, such as weather reports, market bulletins, lists of dealers, etc.; 25 reported results of soil surveys, and 75 were popular, not including popular editions of regular bulletins. Eliminating the reports, more than one-fifth of the number of publications fell in the classes of regulatory, general service, and popular information. The extent to which the regulatory functions figure in the published work is somewhat surprising, as is also the number of bulletins or circulars of general information or of extension character. These show a larger measure of similarity in their titles than do the regular bulletins.

Taking up the subjects of the various publications, it is found that those in horticulture, for example, cover a wide range of special topics, with little repetition except in the case of the popular articles. On special fruits like the apple, the titles read almost like a synopsis of the subject—fertilizing, pruning, scion selection from high and low yielding trees, bud selection, off-year bearing, pollination, self-sterility and cross-sterility, propagation of apples on their own roots, seasonal composition of apple spurs, and relation of carbohydrates and nitrogen to the behavior of apple spurs, with almost no duplication by different States.

There were thirteen papers on grape growing, ranging from those of general nature to specific ones on such subjects as muscadine grapes in the South, pruning and cost of grape growing in New York, and propagation and pruning in California. Five publications from different parts of the country dealt with spraying or dusting orchards, and five on orchard management originated at stations distributed from Maine to Washington.

Turning to the subject of field crops, which is naturally one of the largest in point of numbers, there are found to be twenty publications on Irish potatoes—two on fertilizers (Conn. and Fla.), one each on spacing of plants, improvement by hill selection, size of seed, and seed degeneration; and under potato diseases, three on mosaic (Me., Minn., and La.), two on scab (Vt. and Wis.), one on leaf roll, and two general treatises on the prevalent potato diseases (Minn. and N. J.). Of seven publications on the sweet potato, two each were on culture and fertilizers and the rest on storage and storage diseases. In addition, four publications treated of field diseases of the crop.

There were sixteen separate issues on wheat, two on breeding for improvement, five on general culture (Mo., N. Dak., Wash., Wis.), three on cost of producing wheat in different sections, three on varieties, and two on seed-bed preparation. On such a staple crop as corn, there were thirteen publications—five on varieties (Md., Miss., S. C., Tex.), one on regional adaptation, five on general experiments ranging from Mississippi to Montana, three on fertilizers, one on planting rates and distance, and one a study of the corn plant. The thirteen bulletins on cotton included three on cotton growing (Ariz., Miss., N. Mex.), two on general culture (Miss. and Ga.), three on varieties (Ark., Ga., Tex.), two on breeding, and three on fertilizers (Ga. and Ala.). Alfalfa led the forage crops with nine separate publications—three on culture and suitability (Miss., R. I., Wis.), three on irrigation and soil moisture (N. Mex. and Utah), two on seed growing (Colo. and Utah), and one on fertilizers. The eight bulletins on soy beans related to experiences with that crop in as many States.

Of the twenty bulletins on soils, five were on the general subject of soil fertility and its maintenance (Ill., Ky., N. Y., Ohio, Pa.), five were devoted to nitrification and nitrogen fixation (Colo., Ill., Iowa, Tex.), two to fallowing, two to soil management under different conditions, and one to soil acidity. There were very few general bulletins or circulars on entomological subjects. Most of them dealt with separate insects, with few duplicates, or with spraying in widely separated areas. The same applied to diseases of plants, in which the publications for the most part related to definite classes of diseases.

In dairying there were three circulars on the general subject of feeding dairy cattle, two on production of clean milk, and several bulletins on the germ content of milk as influenced by milking machines and other conditions. The feeding experiments were all different and dealt with specific feeds or rations.

Hog production, one of the most common topics in animal husbandry, contributed fourteen publications—four on the general subject (Del., Iowa, Pa.), seven on miscellaneous feeding experiments in five States, and three on soft pork (Ala. and Fla.). On the subject of beef production there were twenty-eight publications, seventeen relating to steer feeding including summer and winter feeding, comparison of rations, shelter, etc., made under the varied conditions of Arizona, Idaho, Indiana, Kansas, Minnesota, North Carolina, Oklahoma, Oregon, Texas, West Virginia, and Wyoming; four on silage in cattle feeding (Ind., Kans., Ky., S. Dak.), and five on particular feeds like alfalfa, pea straw, corn, cottonseed and soy beans. Lamb feeding and fattening was the subject of eleven bulletins and circulars (Colo., Ind., Iowa, Kans., Ohio, Ore., Tex.) aside from those of general nature, including shelter, forage crops, grain, sorghum, silage, and beet products.

While some of the more general titles are repeated in a number of the publications, inquiry into the points covered discloses important differences in the experiments and in the conditions under which they were made. A further survey of earlier publications would doubtless bring about more evidence of duplication of title and possibly of similarity in the work reported; but this would merely confirm the fact that certain lines of experimentation have been followed through from their elementary to their more advanced stages.

Turning to the list of projects, it is found that seven stations are working on soil acidity as to its nature, the factors concerned, conditions affecting it, etc., but these cover quite a wide section of the country. Liming is also receiving attention at ten stations, but the experiments are on a variety of soil types and cover a large number of subdivisions of the subject, such as means of estimating lime requirement, rate of application, comparison of different forms and

grades of lime, decomposition, downward movement in the soil, and fate of the coarser limestone particles.

Soil fertility is a broad general subject which serves as a catch-all for a wide range of projects. Such experiments are carried on by fully half the stations, and under less general titles by several others. Some of the projects are quite broad and indefinite, while others are specific studies of factors of fertility, green manures, fertilizers, and rotation experiments to maintain or restore crop-producing power; determination of response to particular fertilizing elements, special requirements for such materials as sulphur, residual effect of crops, humus formation, comparison of grain and stock farming systems, etc. The subject also includes the effect of cropping and of soil management on the physical, chemical, and other qualities of the soil, its bacterial flora and the undetermined changes which are seen in the influence of succeeding crops. It deals, furthermore, with the maintenance of productiveness of soil for such special crops as tobacco, cotton, wheat, and truck crops, and it includes in some cases the manner of applying or utilizing the manure supply of the farm.

The subject is such a broad one that in some form or other it must command the attention of almost every station, for it is perhaps the largest and most fundamental problem in agriculture. There is little occasion for any State to duplicate the work of others, for each section has its special conditions and aspects which govern the character of the effort.

There may be some ground, however, for feeling that considerable of the work with rotations, fertilizers, green manures, and other means of keeping up fertility have followed along quite conventional lines for many years and is not at present contributing much which is essentially new in principle. If the common methods so long employed were adequate, they should have settled many of the general questions which are still being worked upon. In several instances the field experiments have progressed but little in their form of attack and have reached a stage of rather fixed routine. In such cases the opportunity for original and progressive study of the distinctive factors is sacrificed in the pursuit of the broad subject from an empirical point of view. It is conceivable that to the casual observer there might seem to be considerable duplication of earlier experimental work, and the general summaries published from time to time lend color to the inference.

On the other hand, the considerable amount of intensive study now in progress on various aspects of this question should not fail of mention or be obscured by that which, while adhering more closely to the methods of the past, frequently contributes the larger bulk of data for publication. Here as elsewhere a station administration should

not fail to realize when a series of experiments has passed into the routine stage and ceased to be productive of new light or to mark progress.

Coming to the field crops, 147 projects are listed for corn, the largest number of any single crop, but these include no less than 43 on genetic studies, breeding and selection experiments, and improvement work aiming at better local adaptation, not to mention variety tests in 27 of the States where corn is grown for grain or for silage. Possibly the variety-testing stage should be more largely passed than the list would indicate, but the latter includes a number of the newer States and several sections where attention to improvement of the kinds grown is comparatively recent. There are experiments on culture, rate and date of planting, etc., in ten States, with little or no duplication, and fertilizer experiments in ten States on different forms, amounts, methods of application, etc., showing a large measure of individuality. Others deal with a wide variety of special subjects connected with the corn plant, its development and use.

The work upon this crop may be taken as typical of others, often embracing experiments over a quite wide range of States and covering many different aspects, so that little ground lies for a charge of unprofitable duplication. Some of the experiments have been going a number of years, and if we go back we find similar work elsewhere at an earlier date, but on the whole the program is to a large extent progressive in its trend, dealing with new questions arising from time to time or meeting the needs of different sections. In some cases the titles may not suggest a new point of view or an advance in the manner of studying the subject, but inquiry into the nature of the work as at present conducted will often show that it has advanced far beyond the title and is a live undertaking embodying new points.

The leading subject under the head of horticulture in point of projects is the apple. In the list are fifteen projects on breeding in as many States, twelve on varieties ranging in location from Alaska, Vermont, and Wisconsin on the north, to the Southern States and New Mexico, and twelve on fertilizers in the principal apple-growing sections of the East and Central West. Some of the latter are of general nature, while others aim at the physiological effect of fertilizing elements, the influence on fruit buds, on color of fruit, and similar points. Factors concerned in fruit bud formation and fruit spurs, bud variation and bud selection, embrace a half dozen projects.

There are several on apple stocks, relation of stock and scion, comparison of budded and grafted trees, and top-working apples, but no conspicuous duplication. The eleven recorded projects on pruning range from a few of general nature in widely separated localities to

those dealing more specifically with the physiology of the process, effect on percentage of apple blossoms that set fruit, effect on off-year production, etc. There are two on thinning, four on winter injury (N. H., N. Y., Ohio, Wis.), a chemical study on the ripening of fruit, several on picking, storage, and marketing, and three on the best age of trees for setting in the orchard (Mass., N. Y., Okla.).

Turning to apple diseases, a long list of projects is recorded dealing with specific diseases, and experiments on the control of pests by spraying and dusting. On the whole, it will be seen that the subject of apple growing is being quite broadly covered, and in a progressive manner, with the attempt to get at fundamentals and embodying but little repetition.

Such research projects as fall under the head of plant diseases are notable for their individuality, since the investigator aims at originality and measures his success by new findings. Much the same is true in entomology. Under the latter head, a subject of popular interest like beekeeping frequently meets with calls for local work or information which is elementary. The upwards of thirty projects in that subdivision include similar work of a general nature in several localities, but these are in the minority and the list as a whole shows rather surprising diversity.

Many of the feeding experiments with different kinds of live stock will impress the casual reader as following along much the same lines as were followed in the past, with variations due to feed combinations, prices, and other conditions. While a closer view will show that new feeds are being taken up as they come into prominence, and other questions of practical importance are embodied for which information is demanded, it is probably true that feeding experiments have not made the progress that some other classes of work have in getting away from the economic aspects to the study of more permanent factors. Quite largely they are the work of the practically visioned worker, much as was the case years ago, using somewhat more carefully guarded methods, but not as a rule being led by his work into the philosophy or the physiology of the principles of nutrition and stock production. This gives to the work a certain element of sameness which may impress the observer as involving much that is not essentially new, and therefore to an extent representing duplication. New information of a certain kind is unquestionably resulting from it and it is serving as a helpful guide to practical feeders, but in a sense the product is more like that derived from experience than that resulting from advanced research.

Despite this, the unprecedented amount of investigation in the theory of nutrition and on the frontier of original inquiry in this field will be recognized by all who are familiar with what is being

done. It is marking significant progress and is changing the teachings of classroom and textbook, and the writings of more popular character. While it undoubtedly has an effect on the rank and file of experimenters, its influence on the kind of experiments comprising the large bulk of the feeding work is not very pronounced, judging by the predominance of comparative trials.

These considerations of the publications and the experimental work at present under way are felt to give little ground for criticism of actual duplication or the going over of ground already sufficiently covered. The situation in other topics not mentioned is analogous to that of the ones cited. It is quite evident that identical or similar matters are frequently being worked upon in different States, but the widely diverse physical and climatic conditions presented by different parts of the country, as well as differences in the status of agriculture, both warrant and require much repetition to enable safe generalizations for practice. An understanding of the situation and of the real character of the work will in large measure relieve any concern lest effort is being wasted through needless duplication.

A better-grounded basis for concern is thought to lie in some cases in a tendency to adhere to earlier methods which have served their purpose and are failing at this stage to broaden the basis of knowledge and understanding. Nothing is more likely to be unprofitable or even harmful than the gathering of facts in a mechanical way without using them as building stones, or recognizing their significance or their limitations. As Karl Pearson has reminded us, "the man with no imagination may collect facts." Progress and discovery depend, in his words, upon a "disciplined imagination," and he declares that "criticism is the essence of the scientific use of the imagination; in fact, the very lifeblood of science."

It is a lack of this critical attitude of individuals toward their work and of inquisitiveness which seeks the meaning of it that prevents advancement beyond a fixed stage. In a general way progress is made in accordance as the point of view changes, and this change comes about from the use of existing knowledge plus vision and imagination. This knowledge may have been acquired by the individual through advanced study, or have come through the result of his own investigations; but ability to use it in acquiring a new point of view and building new facts is largely a result of severe training. When the worker's point of view or his attitude toward his subject does not change, his thinking and action will continue in the same channel as before; and when a man's work and results do not influence him in his thinking and his aspirations, the means of progress in new lines are closed to him except as he follows

the example or directions of some one else. The result may be duplication; it will scarcely be originality.

The idea that thorough training in the science of agricultural subjects is essential to the preparation of resourceful and forward-looking investigators has not yet been as forcefully exemplified in some of the divisions of the subject as is clearly desirable. It is accepted in the branches of science applied to agriculture, but in some of the divisions which lie close to the art there is less evidence of it. It is not required of the new recruits, and in case of combination officers other qualifications are often more heavily stressed. Unless the student comes into closer contact with the primary sciences than he usually does in his undergraduate agricultural course, the prospective investigator may not have impressed upon him the necessity for intensive training and an adequate understanding of abstract science. In that case he starts out under a handicap which affects his vision of his speciality and his attitude toward investigation in it.

Fundamentally, therefore, the question of tendency toward duplication, routine, and the commonplace in experiment station work sifts down to the worker and his preparatory training. If he has been skilled in the art and neglected the sciences the fact will usually be reflected in his work. He may yield to suggestion but independently his work will seek the level he sets for it. Men with intellectual vision who have been stimulated by study to make new contributions, and who see that their own recognition will come in proportion as they advance in their subject, will not be a source of concern lest they duplicate the work of others. Their own impulse will lead them to seek new avenues and new means of progress.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

[Silage studies], Z. N. WYANT (*Michigan Sta. Rpt. 1920, pp. 235-239*).—This progress report includes the results of inoculation, steaming, and salting of alfalfa silage prepared in small experimental silos and similar studies on corn silage prepared in larger experimental silos holding from 250 to 350 lbs. of corn. In the latter case bacteriological studies of the inoculated silages were also made with a view to the selection of the most active and strongest acid producers for further inoculation studies.

Preliminary steaming of the alfalfa was found to be unsuccessful in controlling the organisms producing bad odors in the silage. Steaming also appeared to cause the fermentation to proceed so slowly that the disagreeable odors persisted after their disappearance from the unsteamed silage. Out of 16 samples of alfalfa silage prepared in various ways the only ones eaten with relish by cattle were those steamed or unsteamed to which salt had been added in the proportion of 1 lb. of salt to 100 lbs. of cut alfalfa and which had also been inoculated with a water infusion of fresh corn silage.

In the experimental work with corn silage neither the addition of pure cultures of acid-forming bacteria nor of salt appeared to have any influence on the depth at which mold was found or on the palatability of the silage. Attempts to isolate from the silage at the time of feeding the type of organism originally added to the silage gave conflicting results. It is considered that a sufficient number of bacteriological studies has not yet been made to determine whether pure cultures used as inocula will eventually control the fermentation or whether the natural microflora of the silage will determine the type of fermentation resulting.

H-ion concentration determinations by the colorimetric method of dextrose, sucrose, and lactose broth, to which pure cultures of acid-producing bacteria isolated from some of the silos had been added, are reported, together with pH values of the silage from several silos. Through comparison of the acidity of the silage and that produced in the sugar broths the organisms thought to be most responsible for the pH values of the silage have been isolated and are to be used for further studies in silage inoculation.

A microscopic method for anaerobic cultivation, A. ITANO and J. NEILL (*Jour. Infect. Diseases, 29 (1921), No. 1, pp. 78-81, fig. 1*).—The method described is a modification of the usual moist chamber preparation, the anaerobic system being obtained by the absorption of oxygen in alkaline pyrogallate in a chamber in which the usual cell is placed.

A simple method for determining the number of bacteria in bacterial suspensions, K. A. FRIES (*Centbl. Bakt. [etc.], 1. Abt., Orig., 86 (1921), No. 1, pp. 90-96; abs. in Jour. Amer. Vet. Med. Assoc., 60 (1921), No. 3, pp. 330-333*).—The method consists essentially in the use of a standard suspension of yeast cells in a phenolized salt solution. Two cc. of this suspension is thoroughly mixed with 0.2 cc. of the suspension to be tested. A small quantity of the mixture is taken up with a Pasteur pipette and dropped upon a clean slide which is carefully flamed and stained with diluted fuchsin. The slide is then

examined under an oil immersion lens and, if the cells are well distributed, a count is made of at least 250 yeast cells and the corresponding number of bacteria in the same number of fields. The total bacterial count is then calculated from the formula

$$X = \frac{\text{vol. yeast cells}}{\text{vol. bacteria}} \times \frac{\text{number bacteria}}{\text{number yeast cells}} \times k$$

in which X equals the number of bacteria in millions and k the constant which shows the number of yeast cells in millions per cubic centimeter of the standard yeast suspension.

The standard yeast suspension is made by shaking a piece of yeast the size of a hazel nut in 1 liter of physiological salt solution containing 5 per cent phenol. After the yeast cells have been distributed uniformly throughout the liquid, counts are made in a Thoma-Zeiss or Hayem-Nachetsche chamber. The number of yeast cells should vary between 20 and 30 million per cubic centimeter.

The ionization constants of glycerophosphoric acid and their use as buffers, especially in culture mediums, R. R. MELLON, S. F. ACREE, P. M. AVERY, and E. A. SLAGLE (*Jour. Infect. Diseases*, 29 (1921), No. 1, pp. 1-6, fig. 1).—On account of its solvent action on calcium, magnesium, and perhaps other salts, disodium glycerophosphate is suggested as a buffer in culture media, and as a suitable material for the washing of agar, for the precipitation of casein, and for studying the effect of calcium and magnesium ions on the growth of various organisms.

Titration of culture media, F. W. FARIAN and G. L. A. RUEHLE (*Michigan Sta. Rpt.* 1920, pp. 254-260).—A comparison is reported of three methods of titrating culture media as follows: (1) The standard procedure of diluting the medium with a given amount of water, boiling to expel carbon dioxide, and titrating while hot with phenolphthalein as indicator; (2) boiling the water to expel carbon dioxide, then adding the hot medium, cooling, and titrating the cold mixture; and (3) neutralizing the carbon dioxide in the water with an alkali, then adding the medium to be tested, and titrating as before. These methods and control H-ion determinations by the colorimetric method were used with 12 kinds of gelatin, agar, and broth media diluted with 8 varieties of water, including distilled, double distilled, river, and different well waters, the analyses of which are tabulated.

Of the three methods, the first gave the most variable and inconsistent results. The third gave the most reliable results and is recommended, particularly when distilled water or water of low salt content is not available.

The joint use of two indicators in the titration of acids and bases, J. L. LIZIUS (*Analyst*, 46 (1921), No. 546, pp. 355, 356).—The author suggests that in titrations in which phenolphthalein is used as an indicator the end point can be obtained more rapidly and correctly by the addition of 3 drops of thymolphthalein (0.04 per cent) to the acid solution containing 1 drop of 0.5 per cent phenolphthalein. If the end point is passed the solution becomes violet and can then be titrated back to a pink color with the standard acid 1 drop at a time.

Similarly in titrations with methyl red as an indicator the use of thymol blue is recommended, particularly in titrations of alkaline solutions with $N/10$ acid. As the end point approaches, the blue color of the solution changes to green, then to yellow, and finally to orange.

The change in the H-ion concentration of various mediums during heating in soft and pyrex glass tubes, J. R. ESTY and P. H. CATHCART (*Jour.*

Infect. Diseases, 29 (1921), No. 1, pp. 29-39).—Attention is called to the necessity in the determination of thermal death points of heat-resistant spores of maintaining a constant H-ion concentration throughout the entire period of heating, and data are presented showing the effect of hard and soft glass tubes on the H-ion concentration of solutions contained in them. The tubes used in the investigation were soft glass and pyrex tubes specially constructed as described in a previous paper by Bigelow and Esty (*E. S. R.*, 45, p. 10), and the materials the food juices used in the above-mentioned investigation. In addition, freshly distilled water, physiological salt solution, solutions of hydrochloric acid and sodium hydroxid, and various mixtures of primary and secondary potassium phosphates were boiled in these tubes under the same conditions as used in the determination of thermal death points.

Unbuffered solutions showed an increase in acidity on prolonged heating in hard glass tubes and an increase in alkalinity in soft glass tubes. Prolonged heating of the phosphate mixtures in hard glass tubes did not affect the H-ion concentration, while heating in soft glass tubes altered the H-ion concentration, depending upon the acidity or alkalinity of the solution.

The H-ion concentration of the juices of canned materials was affected less by heating in the soft glass than in the hard glass tubes. It is emphasized, however, that no general statement can be made regarding the relative merits of hard and soft glass tubes in the determination of thermal death points, but that the type of glass to be used must be determined for each solution.

A simple receiver for fractional distillation under diminished pressure, E. J. WILLIAMS (*Chem. News*, 123 (1921), No. 3214, pp. 265, 266, fig. 1).—The apparatus described consists of a small wide-mouthed separatory funnel fitted with a two-holed stopper, through one hole of which passes an adaptor connected with the condenser tube. A bent glass tube through the other hole is connected with a T-tube, one arm of which leads to the manometer and pump. The remaining arm is connected by means of rubber tubing provided with a clamp with another T-tube which, in turn, is connected with the side arm of a small round distilling flask, in the neck of which the separatory funnel is placed and which serves as the receiving flask. In use the remaining arm of the second T-tube is closed by a clamp, while the other connections are open. To change the receiver the pit cock in the separatory funnel and the clamp on the tube connecting the two T-tubes are closed and the remaining clamp opened, thus allowing the receiver to be changed without stopping the distillation.

Remedying defects in moisture tester, A. A. JONES and J. W. BARKER (*Amer. Elevator and Grain Trade*, 40 (1921), No. 6, p. 445, fig. 1).—A device to prevent superheating in the Official Brown-Duvel moisture tester is described and illustrated. The device consists in a cylinder of heavy tinned gauze of 7 mm. mesh, which is provided with a stiff wire handle ending in a ring nearly the size of the opening of the flask. The cylinder is placed in the flask so that it settles in the grain in such a way that when the flask is heated the oil percolates into the cylinder, rises, and flows out in the free oil above the grain, thus assuring even heating of the grain.

Organic chemical reagents, II, R. ADAMS, O. KAMM, and C. S. MARVEL (*Ill. Univ. Bul.* 18 (1920), No. 6, pp. 57, pl. 1, figs. 4).—This bulletin continues the description of methods for the preparation of organic chemicals previously noted (*E. S. R.*, 44, p. 802). Two pieces of apparatus are also described: (1) A round-bottom flask with three necks, allowing use of the center neck for an agitator and the other two for thermometer, reflux condenser, or separatory funnel, and (2) a modification of the boiling flask described by Noyes (*E. S. R.*, 38, p. 309). This apparatus is devised particularly for distilling liquids which have a tendency to attack rubber or cork.

Detection of nitrogen in organic compounds, C. D. ZENGHELIS (*Compt. Rend. Acad. Sci. [Paris]*, 173 (1921), No. 5, pp. 308-310).—The method described makes use of the test for ammonia previously noted (E. S. R., 46, p. 310). To increase as much as possible the amount of nitrogen transformed into ammonia 1 part of copper is added to 2 parts of the soda lime used for oxidation. A small quantity of the substance to be tested is mixed in a crucible with some of the soda lime copper mixture, and the crucible is covered with a watch glass, on the convex lower face of which a few drops of the formol silver nitrate mixture is placed. On the upper concave side a few drops of water is placed to keep the glass cool. The crucible is then heated gently on a sand bath or previously heated quartz plate. If nitrogen is present even in traces only, a characteristic silver mirror is formed on the under side of the watch crystal.

A titration method for the determination of total sulphurous acid in organic substances following distillation, V. FROBOESE (*Arb. Reichsgsndhtsamt.*, 52 (1920), No. 4, pp. 657-669, fig. 1).—In the method described the substance to be analyzed is distilled with phosphoric acid in a current of carbon dioxide according to the Haas method, the distillate is received in a standard sodium bicarbonate solution which is subsequently oxidized with hydrogen peroxid, and the excess of sodium bicarbonate is titrated with hydrochloric acid, with methyl orange as indicator. The method also permits the direct determination of the sulphur dioxide as sulphuric acid by precipitation as barium sulphate. The titration method is said to be suitable for the determination of total sulphur dioxide in sulphite pulp and waste water, and in samples of wine, dried fruits, gelatin, etc., and to be much more rapid than the original Haas method.

A gravimetric method for the determination of small amounts of phosphoric acid, G. EMBDEN (*Hoppe-Seyler's Ztschr. Physiol. Chem.*, 113 (1921), No. 2-3, pp. 138-145).—The reaction employed in the method described is essentially that suggested by Pouget and Chouchak (E. S. R., 26, p. 406) for the turbidity test for phosphoric acid, namely, the precipitation of the phosphoric acid as an alkaloidal phosphomolybdate by the action of an alkaloid such as strychnin on a solution of the phosphomolybdate in nitric acid. The reagent is prepared as follows:

A calculated amount of ammonium molybdate is dissolved in water with warming, and the solution diluted to three times the volume corresponding to the weight of molybdate. One volume of this solution is then added slowly from a pipette to three volumes of a nitric acid solution prepared by diluting two volumes of concentrated nitric acid (specific gravity 1.4) with one volume of water. Just before the test is to be made three volumes of this solution are thoroughly mixed with one volume of a strychnin solution containing 15 gm. of strychnin nitrate in 1 liter. Twenty cc. of this reagent is then added to 60 cc. of the liquid to be tested. The precipitate formed is filtered on a Gooch crucible after from 30 to 40 minutes, washed with ice cold water until the reaction is no longer acid, and dried in the oven at from 105 to 110° C.

Rapid procedure for determining phosphoric acid, H. COPAUX (*Compt. Rend. Acad. Sci. [Paris]*, 173 (1921), No. 16, pp. 656-658).—The method described depends upon the property possessed by phosphates, when mixed with an acid such as sulphuric or hydrochloric and shaken with ether and an alkaline molybdate, of forming a salt of phosphomolybdic acid which dissolves almost completely in the ether. If the proportion of the various reagents is adjusted properly three liquid phases are said to result—an excess of ether, an aqueous solution, and the yellow phosphomolybdic solution. The reagents used consist of a 20 per cent solution of sulphuric acid, a sodium molybdate solution prepared by dissolving 100 gm. of molybdic anhydrid and 32 gm. of sodium carbonate in water and making up to 1 liter, and a standard solution of ammo-

nium phosphate ($\text{NH}_4\text{H}_2\text{PO}_4$) of about 5 gm. per liter. These reagents are mixed in specially constructed flasks with necks graduated in millimeters in the following order: Ten cc. of the standard phosphate solution, 10 cc. of the sulphuric acid, sufficient ether to form a layer of about 3 or 4 mm., and, after thorough shaking, 15 cc. of sodium molybdate solution. Two solutions are made up in this way, and two others in which the standard phosphate solution is replaced by an equal volume of the unknown phosphate solution. The flasks are then centrifuged and the depth of the ether layer read on the graduated neck of the flask.

The amount of phosphate in the unknown solution is calculated by comparing the volume of ether with the standard. The method is said to be quite accurate, but is unreliable when the substance to be analyzed contains citrates.

Detection and quantitative determination of levulinic acid in foods, L. GRÜNHUT (*Ztschr. Untersuch. Nahr. u. Genussmit.*, 41 (1921), No. 11-12, pp. 261-280).—Attention is called to the possible occurrence of levulinic acid in soup extracts, gravy flavoring materials, and artificial meat extracts prepared from vegetable matter, and to the presence also of formic, acetic, and lactic acid in association with the levulinic acid. Methods are described for the determination of these acids.

Contribution to the investigation and estimation of artificial honey, G. BORRIES (*Arb. Reichsgesundheitsamt.*, 52 (1920), No. 4, pp. 650-656).—In the examination of artificial honey the author recommends as standards a maximum value of 10 per cent sucrose and 22 per cent of water. Methods are outlined for sampling the honey and for determining the dry residue and the content of total and reducing sugars. Hydrochloric acid is used for inversion, and the amount of reducing sugars is determined with Fehling's solution.

Contribution to the investigation and valuation of chicory and other coffee substitutes, J. PRITZKER and R. JUNGKUNZ (*Ztschr. Untersuch. Nahr. u. Genussmit.*, 41 (1921), No. 7-8, pp. 145-169).—An indirect method of determining the amount of extract in coffee, which is said to give results in close agreement with those obtained by the direct gravimetric method, is described as follows:

A flask containing 10 gm. of the sample and 200 cc. of distilled water is weighed, after which the contents of the flask are heated to boiling, boiled for 5 minutes, and water added to bring the whole up to the original weight. The suspension is thoroughly mixed and filtered and the specific gravity of the filtrate at 15° C. determined. From this the percentage of extract is calculated from the formula $E = (S - 1) \times 5,160$, in which E equals the extract per 100 gm. of substance and S the specific gravity of the 5 per cent extract. The extract of pure coffee obtained with this technique is said to be about 25 per cent, while that of a large number of substitutes examined rarely fell below 50 per cent.

Other determinations used in the examination of coffee for substitutes included the color intensity of the extract as determined in a Duboscq colorimeter with an iodine solution as a standard, acidity determinations, and the reaction of the sand-free ash. Tables are given showing analyses of 38 chicory coffees and 18 other substitutes by these methods.

The direct quantitative determination of sodium, potassium, calcium, and magnesium in small amounts of blood, B. KRAMER and F. F. TISDALL (*Jour. Biol. Chem.*, 48 (1921), No. 1, pp. 223-232).—The authors have devised a method by means of which sodium, potassium, calcium, and magnesium may be determined quantitatively in 7 cc. of blood. The blood is deproteinized by trichloroacetic acid and the sodium, potassium, and calcium determined on

separate aliquots of the deproteinized fluid by modifications of the methods previously described (E. S. R., 45, pp. 415, 507, 716). The magnesium is determined in the filtrate from the calcium precipitation.

The results obtained by these methods are said to agree well with those obtained on solutions of blood ash. The content of these elements in 100 cc. of human blood is reported as follows: Sodium 170 to 225 mg., potassium 153 to 201 mg., calcium 5.3 to 6.8 mg., and magnesium 2.3 to 4 mg.

Methods for the direct quantitative determination of sodium, potassium, calcium, and magnesium in urine and stools, F. F. TISDALL and B. KRAMER (*Jour. Biol. Chem.*, 48 (1921), No. 1, pp. 1-12).—The methods described for the determination of calcium, potassium, and sodium in the acid extract of the partially ashed residue of urine and feces are slight modifications of the methods previously described (see above). The technique for the magnesium determination makes use of the principle of alkalimetric titration of ammonium magnesium phosphate. It is said that by means of these methods a considerable saving of time is effected, and that the determination may be made quantitatively in 50 cc. of urine or 2 gm. of dry feces.

A method for the determination of sugar in normal urine, S. R. BENEDICT and E. OSTERBERG (*Jour. Biol. Chem.*, 48 (1921), No. 1, pp. 51-57).—In the method described, which is considered to be "perhaps the most specific reduction test available for sugar," acetone is used to destroy the color resulting from the reaction of creatinin with picric acid in the presence of sodium hydroxid. This renders unnecessary the preliminary removal of the nitrogenous constituents of the urine by means of mercuric nitrate, as in the method previously described (E. S. R., 39, p. 112).

Technology of beet sugar manufacture (Denver: Great West. Sugar Co., 1920, pp. X+324, pls. 2, figs. 39).—This book consists of a series of chapters on the important features of the technology of beet sugar manufacture, written by members of the technical and operating staffs of a company located at Denver, Colo. Each chapter is divided into two sections, the first consisting of general descriptive matter for the beginner and the second of a more theoretical treatment of the subject for the advanced student.

Studies on some fungi and the deterioration of sugar, P. A. VAN DER BIJL (*Union So. Africa Dept. Agr., Sci. Bul.* 18 (1920), pp. 19).—Continuing the investigation previously noted (E. S. R., 46, p. 206), the author has made a further study of the factors involved in the deterioration of sugars and sugar solutions by fungi under varying conditions. The fungi used in the present study were five varieties of *Penicillium* and two of *Aspergillus*, isolated from sugars and identified by C. Thom, of the Bureau of Chemistry, U. S. D. A.

Preliminary experiments showed that these organisms are capable of inverting previously sterilized sugar solutions and crystalline sugar, thus indicating their ability to form invertase. The inversion of sugar by these fungi was found to be influenced favorably by the presence of nitrogenous and inorganic food substances in the solution, slight acidity, increased moisture content, and higher temperatures, and unfavorably by high concentration of the sugar, alkalinity, the presence of certain salts, sterilization, cold storage, and the action of various disinfectants.

In conclusion the author points out that in the manufacture of cane sugar the juice is free from fungi when it leaves the boilers and that the aim from that point should be to prevent reinfection. This can largely be accomplished through the use of such hygienic measures as already have been found of advantage in the dairy industry. The chief factors influencing the inversion of sucrose by microorganisms are summarized as the temperature of the surround-

ings, the percentage of moisture present in the sugar, the humidity of the atmosphere, the exposure to infection at various stages after the sirup has left the boilers, and hygroscopic nonsucrose substances present in the raw sugar.

Further studies on some fungi and the deterioration of sugar, P. A. VAN DER BIJL (*Internatl. Sugar Jour.*, 23 (1921), No. 273, pp. 504-507).—A summary of the above paper.

METEOROLOGY.

Possibilities of modifying climate by human agency, with special application to southeastern Australia, E. T. QUAYLE (*Roy. Soc. Victoria Proc.*, n. ser., 33 (1921), pp. 115-132, fig. 1).—It is stated that "many attempts have been made by more or less violent means to compel the atmosphere over dry areas to part with its moisture, and all have been futile." Evidence, mainly rainfall data recorded by the Commonwealth Meteorological Service, is adduced in this paper "to show that methods more in accord with nature's requirements are actually successful."

The author concludes that the area under consideration is under such weather conditions that it will benefit climatically by any considerable increase in surface moisture. "The clearing of the land, and the substitution of cultivation or pastures for the scrub forests on the inland plains cause, according to the evidence, some improvement of the rainfall, especially during the spring months, when the green growth results in vigorous evaporation. A more general improvement results from irrigation, which insures growth of vegetation throughout the year. It is through this means that the greatest effects are possible." It is also believed that the impounding of flood waters on a large scale will also have a marked beneficial effect on the climate. It is estimated that "a reasonable result of this would be an increased rainfall of from 3 to 5 in. in the neighborhood, even as far as 170 miles inland.

"If such a result could be brought about by increasing our irrigated areas, and the necessary increase in the area of land fully irrigated can surely be made, it would be hard to put any limit upon the climatic benefits which northern Victoria and the Riverina would derive from it. Hann has shown that in New South Wales a square mile of country carries 22 more sheep per annum with a 12-in. than with an 11-in. rainfall, and that the carrying capacity increases at a more rapid rate per inch of rain as the rainfall increases, a 17-in. rainfall, for example, enabling 70 more sheep per square mile to be carried than a 16-in. one."

Weather control, D. W. HERING (*Sci. Mo.*, 14 (1922), No. 2, pp. 178-185, figs. 2).—This article reviews briefly various theories, methods, and experiments relating especially to rain formation and control, including those of Espy, Powers, Elmer Gates, Dyrenforth, and McAdie, as well as the "pseudoscientific pretensions and practices" of so-called rainmakers. McAdie is quoted to the effect that "rain control is a scientific possibility. Successful rain engineers will come, in time, from the ranks of those who study and clearly understand the physical process of cloud formation."

The experience of European viticulturists in cannonading to ward off hail is referred to, and it is stated that "the theory of the action is not very definite or well assured. Whether the rings of smoke disrupt the clouds, or whether sufficient local heating of the air causes warm air to rise and intercept the hail, converting it into rain or preventing the congealing of water vapor into hail, is uncertain; but there seems sufficient evidence of the efficacy of the plan in dispersing the clouds and checking the storm of hail."

Standardization in calories of two actinometers adapted to studies in heliotherapy and agricultural climatology, J. VALLOT (*Compt. Rend. Acad.*

Sci. [Paris], 170 (1920), No. 12, pp. 720-722; *abs. in Internatl. Inst. Agr. [Rome]*, *Internatl. Rev. Sci. and Pract. Agr.*, 12 (1921), No. 2, pp. 152, 153).—This article points out the inadequacy from the standpoint of agricultural climatology of the ordinary actinometers or pyrheliometers, which measure solar radiation but exclude sky radiation, and reports comparative tests of the Bellam and Arago actinometers with results favorable to the former for use in researches in agricultural climatology. The Bellam actinometer, which measures total radiation, consists essentially of a blue glass receptacle containing alcohol protected by an exhausted glass sleeve. When acted upon by radiation the alcohol distills off and condenses in a graduated tube, thus furnishing a measure of the radiation. The instrument is especially adapted to agricultural meteorological research, because only two readings a day, one at midday and the other in the evening, are needed to measure the total number of calories supplied during the day by the sun and the sky.

Meteorological observations at the Massachusetts Agricultural Experiment Station, J. E. OSTRANDER and G. E. LINDSKOG (*Massachusetts Sta. Met. Buls.* 395-396 (1921), pp. 4 each).—Summaries of observations at Amherst, Mass., on pressure, temperature, humidity, precipitation, wind, sunshine, cloudiness, and casual phenomena during November and December, 1921, are presented. The general character of the weather for November is briefly discussed, and the December bulletin gives a summary for the year. The principal data in this summary are as follows:

Mean pressure, 30.04 in.; mean (hourly) temperature, 49.5° F., maximum 96°, June 22, minimum -6°, January 19; total precipitation, 42.22 in., snowfall, 37.5 in.; cloudiness, 1,819 hours; bright sunshine, 2,695 hours; prevailing direction of wind, west southwest; total movement, 52,373 miles, maximum daily, 465 miles, January 25; last frost in spring, May 12; first in fall, October 9; last snow, April 18, first, November 7.

[**Meteorological observations at East Lansing, Mich.**], D. A. SEELEY (*Mich. State Bd. Agr., Ann. Rpt. Sec.*, 59 (1920), pp. 141-154).—Daily and monthly summaries of temperature (maximum, minimum, and mean), precipitation, cloudiness, and sunshine, and monthly summaries of pressure (maximum, minimum, and mean), wind movement, and miscellaneous phenomena (frost, hail, thunderstorms, fogs, auroras, and halos) at East Lansing, Mich., are given for the year ended June 30, 1920.

Climatological data for the United States by sections (*U. S. Dept. Agr., Weather Bur. Climat. Data*, 8 (1921), Nos. 9, pp. [186], pls. 3, fig. 1; 10, pp. [186], pls. 3, figs. 2).—These numbers contain brief summaries and detailed tabular statements of climatological data for each State for September and October, 1921, respectively.

SOILS—FERTILIZERS.

The importance of new soil investigations for agriculture, J. KÖNIG and J. HASENBÄUMER (*Landw. Jahrb.*, 55 (1920), No. 2, pp. 185-252).—A number of the more recently developed soil-investigation processes are reviewed quite comprehensively, and those features of the results obtained which have an important bearing on soil fertility and agricultural development are studied and discussed. Among these processes are the determination of available plant nutrients in soils by use of acids and salts, determination of easily soluble nutrients in soil by use of water under pressure, determination of soluble plant nutrients in soil by dialysis, osmotic pressure, and electrolytic conductivity, the catalytic power of soil and the effect of oxidation, influence of carbon dioxide in soil, determination of the oxidizing power of soil, nature and determina-

tion of soil colloids, absorption and adsorption in soil, and the nature and importance of soil acids.

It is concluded that these studies and processes have established new conceptions upon which to base the judgment of soil. Important among these are hydrogen-ion concentration as an indication of the degree of soil acidity or alkalinity, titration acidity as an indication of lime requirements, the relation of the size of grains of individual soil, and the content of colloids, gels, and exchangeable salts.

Methods of studying the concentration and composition of the soil solution, F. W. PARKER (*Soil Sci.*, 12 (1921), No. 3, pp. 209-232).—In a contribution from the Wisconsin Experiment Station, an investigation is reported which was made to study some of the methods which have been used in determining the concentration and composition of the soil solution and to compare the results obtained by them. It was especially desired to devise a method with which the true soil solution may be obtained from a soil at ordinary moisture contents in sufficient quantities for analytical work.

The so-called displacement method was studied and compared with other methods. This method consists of packing the moist soil in a cylinder provided with an outlet at the bottom. Ethyl alcohol is then poured on top of the soil column, and as it penetrates the soil it displaces some of the soil solution which forms a zone of saturation below the alcohol. This zone increases in depth as it is continually forced downward by the alcohol. When the saturated zone reaches the bottom of the soil column, the clear soil solution, free of alcohol, drops from the soil as gravitational water.

Results obtained with the displacement method did not agree with those obtained by Bouyoucos and McCool with the freezing-point depression of soils (E. S. R., 38, p. 16), with regard to the concentration of the soil solution at different moisture contents and the forms of water in the soil. Therefore a study was also made of the freezing-point method and factors affecting the freezing-point depression of the soil solution, and the effect of finely divided material on the freezing points of water, benzene, and nitrobenzene was determined. It was found that ethyl alcohol is more satisfactory as a displacing liquid than water, methyl alcohol, acetone, or liquids nonmiscible with water.

The composition of the soil solution obtained by displacement was not influenced by the displacing liquid used. Successive portions of the displaced solution gave the same freezing-point depression and contained the same amount of total salts. The concentration of the displaced solution was found to be inversely proportional to the moisture content of the soil. The displacement method gave the same amount of nitrate nitrogen and approximately the same amount of total salts as a 1:5 water extraction of the soil. The method seems to be well adapted to a study of the composition and reaction of the soil solution under any condition.

Finely divided material was found to cause a depression of the freezing point of water, benzene, and nitrobenzene when the amount of liquid was reduced until it was in the film or capillary condition. The freezing-point method did not give a measure of the concentration of the soil solution directly in the soil at ordinary moisture contents of the soil. At high moisture contents, probably only above saturation, the freezing-point method gave a measure of the concentration of the soil solution. The freezing-point depression due to solid material at the moisture equivalent was found to be very nearly a constant for a number of soils.

It is concluded that a soil does not cause a considerable amount of water to be removed from the rôle of a solvent as has sometimes been assumed.

The solubility of anions in alkali soils, W. P. KELLEY and S. M. BROWN (*Soil Sci.*, 12 (1921), No. 3, pp. 261-285, figs. 12).—Studies conducted at the Citrus Substation of the University of California on the solubility of sodium salts as they occur in natural alkali soils are reported. The effect of time on the extraction of salts, the effect of different ratios of soil to water, and the rate of solution of the several anions present in sandy loam, fine sandy loam, and light sandy soil were investigated.

It was found that the use of compressed air in filtering extracts of alkali soils did not materially affect the content of carbonate or bicarbonate. The amount of total solids dissolved by water increased as the time of shaking was increased, but there was no consistent variation in the amount of any one of the anions. The conclusion is drawn that shaking for one hour brings about approximate equilibrium between water and the soils studied. The total amounts of carbonate and bicarbonate removed from two of the soils were found to increase as the ratio of water to soil was increased, while the third soil showed no substantial difference in the amount of carbonate dissolved. Approximately equal amounts of chlorid and nitrate were dissolved by every ratio of soil to water that was used, while in the case of two of the soils studied the amount of dissolved sulphate increased somewhat as the proportion of water was increased.

The concentration of OH ions in the extracts of two soils was lowest where the ratio of soil to water was 1:2 and substantially increased with dilution, reaching a maximum with one soil when the ratio was 1:10 and with the other soil when the ratio was 1:40. It is pointed out that the pH value of extracts or suspensions of alkali soils may be substantially higher than that of the soil solution as it occurs in the open field. By extracting the same portion of soil successively with water it was found that greater amounts of normal carbonate were dissolved by the second extraction than by the first, whereas a very large percentage of the chlorid, sulphate, and nitrate were dissolved by the first extraction.

Solutions of substantially different chemical nature were obtained from each soil by extracting them with successive portions of water. The first extracts were composed mainly of chlorid, sulphate, and nitrate, while the succeeding extracts were composed of increasing percentages of carbonate or bicarbonate. These results are taken to indicate that alkaline salts are either adsorbed or held in loose chemical combination by soils to a much greater degree than neutral salts.

Does a relation exist between hygroscopicity and mechanical analysis of soil? W. NOVÁK (*Landw. Jahrb.*, 50 (1917), No. 3, pp. 445-453).—Studies with 27 different soil types are reported which showed that soils having the same hygroscopicities may have entirely different mechanical compositions.

It was found that there is no regular relation between hygroscopicity and the smallest hydraulic value on the Schön scale indicating the content of the finest particles capable of sedimentation. Likewise no valid general relation was established between hygroscopicity and the content of raw clay or of particles of a size smaller than two microns. This is ascribed mainly to the content of humus substances in the soil.

For practical purposes a high proportion of the particles capable of sedimentation or a high content of raw clay is accompanied by a high hygroscopicity. This is more probable in the case of a high raw clay content, and much more so in humus free soils than in soils containing much humus. However, no generally valid relation exists. It is further concluded that neither mechanical analysis nor hygroscopicity determination gives a clear indication of soil character, but that they must be considered as supplementary physical studies.

Subterranean moisture streams and their importance for the water economy of soil, C. MEZGER (*Jour. Landw.*, 69 (1921), No. 1, pp. 49-64).—Studies are reported which indicated that the variations in density of water vapor produce moisture streams in the soil which are independent of the conditions of rest or movement of the soil air, and which either proceed into the open air or can come from the open air. Their direction is governed by the decrease in density of the moisture, and they can move upward or downward. They thus can govern the increase or decrease of soil moisture, according to whether they pass into the open air by evaporation or from the air into the soil by condensation. In the average year evaporation and condensation are said to be approximately the same.

It is concluded that the subterranean moisture streams are, therefore, of great importance in the origin, distribution, and loss of soil moisture.

Soil survey of Madison County, Iowa, T. H. BENTON and H. B. WOODROFFE (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils*, 1918, pp. 40, fig. 1, map 1).—This survey, made in cooperation with the Iowa Experiment Station, deals with the soils of an area of 360,320 acres lying within the glacial and loessial province in south-central Iowa. The surface is that of a broad loessial plain, and the topography varies from flat or gently undulating to rolling and hilly. With the exception of certain level areas the natural drainage over the county is said to be good, with excessive run-off leading to erosion on the steeper slopes.

The soils are of loessial, glacial, alluvial, and residual origin. Fifteen soil types of 12 series are mapped, of which the Tama silt loam and Shelby loam cover 50.3 and 19.9 per cent of the area, respectively.

Soil survey of Marshall County, Iowa, A. H. MEYER and E. I. ANGELL (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils*, 1918, pp. 35, fig 1, map 1).—This survey, made in cooperation with the Iowa Experiment Station, deals with the soils of an area of 366,080 acres in central Iowa. The area lies entirely within the glaciated region, and the topography varies from gently undulating to steeply rolling and broken, with most of the area rolling. All parts of the county are said to be well drained.

The soils are grouped as upland, terrace, and first bottom soils. Including muck, 16 soil types of 12 series are mapped, of which the Tama silt loam and Carrington loam cover 59.4 and 10.2 per cent of the area, respectively.

Soil survey of Dakota County, Nebr., F. A. HAYES and H. L. BEDELL (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils*, 1919, pp. 42, fig 1, map 1).—This survey, made in cooperation with the University of Nebraska, deals with the soils of an area of 165,120 acres in the northeastern corner of Nebraska. About three-fifths of the total area is upland and the remainder bottomland, including terraces. The topography of the upland ranges from gently undulating or rolling to hilly and extremely dissected, while the bottomland and terraces have a generally flat surface. As a whole the county is said to be well drained.

The soils are grouped as upland, colluvial and alluvial slope, and first bottom soils. Including riverwash and rock outcrop, 13 soil types of 6 series are mapped, of which the Marshall and Knox silt loams cover 42.2 and 17.3 per cent of the area, respectively.

Soil survey of Redwillow County, Nebr., L. A. WOLFANGER and A. W. GOKE (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils*, 1919, pp. 48, fig. 1, map 1).—This survey, made in cooperation with the University of Nebraska, deals with the soils of an area of 455,040 acres lying in the Great Plains region in southern Nebraska. The surface consists of groups of nearly level dissected tables separated by broad, deep valleys. Loess covers the entire upland area

of the county, and is the most extensive soil-forming material. Drainage is said to be everywhere good, with the exception of a small area.

The soils of the county are of loessial and alluvial origin. Twelve soil types of 6 series are mapped, of which the Holdrege and Colby silt loams cover 59.6 and 24.5 per cent of the area, respectively.

Composition of some soils from the Chautauqua County grape belt, R. C. COLLISON (*New York State Sta. Tech. Bul. 85 (1921), pp. 15, fig. 1*).—Partial analyses of 152 samples of soil taken systematically in the so-called grape belt of Chautauqua County, N. Y., are reported in this bulletin. This belt contains about 87,000 acres. The analyses indicate that the majority of the grape-belt soils are well supplied with nitrogen, potassium, and magnesium, deficient in phosphorus and calcium and very deficient in carbonates. These results are taken to indicate that these soils in general would respond to applications of phosphates and lime.

Certain vineyard experiments in the belt are said to indicate that present deficiencies in these soils apparently do not greatly influence the yield of grapes, but that over a long period these deficiencies may become effective in decreasing yields.

Analytical studies of soils, A. L. GUASTAVINO (*Rev. Facult. Agron. La Plata, 3. ser., 14 (1921), No. 2, pp. 31-81, figs. 15*).—Physical and mechanical analyses as prime factors in the classification of soils are discussed and applied to certain soils of Argentina.

Soils in the Pirdop Province [Bulgaria], N. PUSCHKAROFF (*Spisanie Zemedel'skitate Izpitatelni Instituti Bŭlgariŭa (Rev. Inst. Recherches Agron. Bulgarie), 1 (1920), No. 5-6, pp. 325-372*).—This report deals with the soils of an area of about 225,360 acres in the neighborhood of Sofia in Bulgaria. The surface of the area is that of a deep valley. The soils are prevailingly of a podsol nature, and seven distinct types of podsol are recognized, the physical and chemical properties of which are set forth in tabular form.

Most of the soils are high in gravel, sand, and sand-clay particles. Only those soils over marl beds and recent volcanic rocks contain free clay. These soils are all deficient in humus with the exception of certain peaty podsoles. They are considered to have an average content of nitrogen and phosphoric acid, and some of them are rich in potash. Only the marly soils are rich in lime, while the other soils contain an average amount. In the well developed podsol soils the iron compounds are well leached out.

These soils are considered to be well supplied with plant nutrients when compared with the podsol soils of countries having wetter or colder climates. In spite of this, however, shallow rooting crops can not be profitably grown without the application of water. It is concluded that the poor crops can be attributed mainly to the physical properties of the soil. These can be improved by foresting the steep mountain slopes to prevent the transportation of gravel by mountain streams onto the level land.

The effect of straw on the biological soil processes, T. J. MURRAY (*Soil Sci., 12 (1921), No. 3, pp. 233-259, fig. 1*).—Studies conducted at the Washington Experiment Station to determine why the addition of straw to the soil causes a decrease in the subsequent crop yield are reported.

The addition of straw to the soil had a harmful effect on nitrate accumulation after a given time, which increased as the amount of straw increased. Total nitrogen determinations made throughout the work showed that where there was a loss in nitrate nitrogen it was transformed to some other form of nitrogen, and was not lost to the soil. As the amount of straw increased the loss of nitrates already in the soil increased. Straw acted as a source of

energy for nitrogen-fixing bacteria, although the amount of nitrogen fixed was not dependent upon the amount of straw.

Ammonification was inhibited when the amount of straw present exceeded 0.9 per cent, and the harmful effect increased as the amount of straw increased. Straw had no effect on the kind of bacteria present in the soil. Cellulose from either filter paper or straw had no effect on the nitrate-forming bacteria.

The conclusion is drawn that straw applied to soil stimulates the reproduction of bacteria, and that the bacteria use the straw as a source of carbon and the soil nitrates as a source of nitrogen. The nitrates are transformed to organic nitrogenous material and are temporarily lost as available plant food, the intensity of the reaction apparently depending upon the amount of straw.

Notes on furrow system of applying manure, A. C. BARNES (*Calif. Citrogr.*, 6 (1921), No. 12, p. 405, figs. 3).—The results of six years' experience on the furrow method of applying manure in orchard soils are summarized, indicating that furrows should be as deep as possible, with due consideration to the distribution of the root system, and should not be filled beyond the level reached by cultural implements. Furrows should be located between irrigation rows if possible, and should have considerable capacity at the greatest depth. The furrow should be closed immediately after spreading the manure.

It has been found that manure placed in furrows located away from irrigation water becomes dry and sometimes heats.

Carbon-dioxid nutrition of plants and stable manure, GERLACH (*Mitt. Deut. Landw. Gesell.*, 36 (1921), No. 9, pp. 147-150).—The author reviews the work of others bearing on the subject, and reports the results of studies from which the conclusion is drawn that enriching the atmosphere surrounding plants in carbon dioxid has no practical agricultural importance.

The greater part of the action which animal manures exercise on crops is attributed to their content of nitrogen, potash, and phosphoric acid. When stable manures were applied as top-dressings they had only a small influence on the development of crops. No evidence was obtained that stable or green manures acted as producers of carbon dioxid which was used by crops on the field in question.

Use of commercial fertilizers, P. WAGNER (*Anwendung Künstlicher Düngemittel. Berlin: Paul Parey, 1920, 7. rev. ed., pp. XII+196*).—This is the seventh revised edition of this book (E. S. R., 13, p. 635). It discusses first the fertility constituents of soils and the important plant nutrients, with particular reference to their maintenance in the soil in proper amounts and proportions by the use of commercial fertilizers.

Methods for determining the fertilizer requirements of soils by means of chemical analysis of soils and plants and pot and field experiments are next discussed. The conclusion is drawn that no certain indications of fertility requirements of soils can be obtained from chemical analyses of soils or plants or from pot experiments. The results of precise field experiments are thought to give the most valuable indications of fertility requirements of soils, and in this connection a plan for the conduct of exact field experiments is described, which embodies complete fertilization and complete fertilization without each of the three main fertility constituents. The results of some field experiments are given to illustrate the procedure.

A detailed discussion follows of fertilization with each of phosphoric acid, potash, and nitrogen, in which the needs of different soils and plants for these materials are considered and the proper uses of different commercial materials containing fertility elements are described. Special attention is paid in this connection to the newer forms of nitrogenous fertilizers. A fertilization plan for a complete rotation is also presented.

Mineral resources of the United States in 1918, M. B. CLARK (*U. S. Geol. Survey, Min. Resources U. S., 1918, pt. 1, pp. 7a-145a, fig. 1*).—This is a final summary of mineral production in the United States for the year 1918, containing all statistical data appearing in the preliminary reports and tables of production by States. Sections are included on the various minerals, giving data on domestic and foreign production, consumption, imports, exports, stocks, and prices. The minerals discussed include potash, phosphate rock, peat, lime, marl, and sulphur.

Statistical supplement to the final report of the Nitrogen Products Committee of the Ministry of Munitions, compiled by J. A. HARKER (*London: Dept. Sci. and Indus. Research, 1921, pp. 22*).—The scope of this supplement to the final report of the committee (E. S. R., 43, p. 218) is restricted to the statistical aspect only. It includes tabular data on the world's demand for fixed nitrogen; the Chile nitrate, saltpeter, nitric acid, by-product, synthetic ammonia, Norwegian fixation, cyanamid, ammonia oxidation, and fertilizer industries; miscellaneous matters; and British developments in nitrogen fixation.

Potassium sulphate and potassium magnesium sulphate as fertilizers for potatoes, A. JACOB (*Mitt. Ver. Förd. Moorkult. Deut. Reiche, 39 (1921), No. 17, 325-329*).—The results of 20 fertilizer experiments with potatoes to compare chlorid and sulphate potassium fertilizers are reported, showing that in 15 cases the greatest yields were obtained with salts containing no chlorid, while in the 5 remaining cases the greatest yields were obtained with potassium chlorid or potassium chlorid mixed with kieserite. In 17 out of the 20 cases the salts free from chlorids gave the highest starch yield.

It is recommended that in spite of its high price potassium sulphate be given a thorough test by farmers.

Antagonism, O. NOLTE (*Landw. Jahrb., 55 (1920), No. 2, pp. 287-291*).—A brief review is given of studies relating to the theory of the lime factor and of the lime-potash law. It was found that the assimilation of potash by certain grain crops at first decreases and then increases when a part of the potash is displaced by sodium. Where magnesia was substituted for lime the content of lime in grain crops decreased, while those of magnesia and phosphoric acid increased. The potash content first increased and then decreased, and the sodium content steadily decreased. The greatest plant yield was obtained when the ratio of the lime to the magnesia contents was 1 : 1. Where lime was substituted for potash the lime content of grain crops increased, and the potash, sodium, and phosphoric acid contents decreased.

A comparison of magnesian and nonmagnesian limestones, A. W. BLAIR (*Jour. Amer. Soc. Agron., 13 (1921), No. 5, pp. 220-225*).—The results of 11 years' work at the New Jersey Experiment Stations with calcium and magnesian limestones on four different crop rotations are reported.

The materials were applied at rates of $\frac{1}{2}$, 1, and 2 tons per acre, and the soil is a loam or gravelly loam. Using the total amount of nitrogen returned in the crops as a measure, the two forms of limestone gave results which are very nearly the same. The magnesian limestone appeared to have a slight advantage. Measured by the hydrogen-ion concentration and by determinations of lime requirement of samples of the treated soil, the two limestones also showed about the same corrective power. There was no indication of any toxic effect due to the use of magnesian limestone.

The comparative effects of various forms of lime on the nitrogen content of the soil, C. A. MOOERS and W. H. MCINTIRE (*Jour. Amer. Soc. Agron., 13 (1921), No. 5, pp. 185-205, figs. 5*).—In experiments conducted at the Tennessee Experiment Station, calcium oxid, calcium hydrate, precipitated calcium carbonate, ground limestone, ground dolomite, and precipitated magnesium

carbonate were used in four series of experiments on Cumberland loam soil for a 5-year period, to determine their effect on the content of the total nitrogen in the soil. The lime materials were applied in amounts equivalent to 2 and 8 tons per acre of calcium oxid, both with and without stable manure.

The experiments were conducted in 128 rims exposed to open-air conditions. Each rim was 1 ft. deep and 2.225 ft. in diameter, the surface area of exposed soil being $\frac{1}{10,000}$ acre. Thirty-two rims were used in each of four similarly treated series. In the first series one crop of lespedeza and three crops of cowpeas were grown and removed as hay. In the second series no crop was grown, and the soil was disturbed as little as possible throughout the period. In the third series no crop was grown, but the soil was cultivated from time to time throughout the growing season. In the fourth series tall oats grass was grown continuously.

The first three series all showed marked and very similar losses of soil nitrogen. The fourth series showed the least loss. At the end of the 5-year period the average percentage of soil nitrogen in the rims of the fourth series was 0.1144, but the average from the three other series was only 0.0993. The average percentage of nitrogen in a series at the outset was 0.1174. All forms of lime caused a loss of soil nitrogen, the 8-ton rates noticeably surpassing the 2-ton in this respect. At the 2-ton rate calcium oxid, calcium hydrate, and precipitated calcium carbonate induced losses similar in extent, which were specially apparent in the first three series. The 2-ton applications of limestone and dolomite induced appreciable losses in the first three series, but not in the fourth. At the 8-ton rate calcium oxid and calcium hydrate caused large losses of soil nitrogen in all series, especially the first three. Precipitated calcium carbonate, ground limestone, and dolomite produced losses which were similar one to the other but much less in amount than those produced by either the oxid or hydrate of calcium.

As might be expected from their relative coarseness, ground limestone and dolomite induced the least loss of soil nitrogen. On the other hand, the very fine, precipitated calcium carbonate, while inducing losses almost identical with those induced by the oxid and hydrate of calcium when applied at the 2-ton rate, ranked with the ground limestone and dolomite in producing the smallest losses when applied at the 8-ton rate. Precipitated magnesium carbonate induced losses comparable with those induced by precipitated calcium carbonate.

The lespedeza and cowpea crops produced slightly more dry matter than the tall oats crops. The nitrogen removed by the cowpeas, however, was nearly two and a half times that removed by the oats grass. All forms of lime produced greatly increased yields of both crops, but distinctions between the effect of the different forms were not made. At the 8-ton rate ground limestone and dolomite produced much larger yields of cowpeas than did any other form. This was not the case, however, with tall oats grass. The evidence is considered conclusive that both the oxid and hydrate of calcium when applied at the 8-ton rate resulted in a waste of nitrogen, the losses being greater from the soil but with no more nitrogen in the crops than when either precipitated carbonate, ground limestone, or dolomite was applied. Under cropping and with liming at the 2-ton rate no one form plainly produced a greater loss of soil nitrogen than the others.

The value of liming in a crop rotation with and without legumes, J. G. LIPMAN (*Jour. Amer. Soc. Agron.*, 13 (1921), No. 5, pp. 206-210).—The results of experiments which have been in progress for 13 years at the New Jersey Experiment Stations, dealing in part with the lime factor in the transformation and accumulation of nitrogen in soils, are reported.

It was found that in rotations of nonlegumes lime is not a vital factor in increasing nitrogen yields, except in the case of soils well supplied with organic matter or so deficient in lime and other basic materials as to lead to textural deterioration or the formation of toxic compounds of aluminum and iron. With rotations of nonlegumes it is considered difficult and uneconomical to maintain an adequate supply of nitrogen in the soil.

Crop rotations which included legumes were found to indicate the importance of lime for the proper accumulation of nitrogen from the atmosphere. Where the lime requirements of the land are more or less pronounced the use of lime becomes an important factor in maintaining an adequate supply of nitrogen in the soil.

Liming as related to farm practice, F. D. GARDNER (*Jour. Amer. Soc. Agron.*, 13 (1921), No. 5, pp. 210-220).—This is a summary of experimental work, mainly at different State experiment stations, on practical phases of the use of lime on soils.

An investigation of sulphur as a plant food, G. A. OLSON and J. L. ST. JOHN (*Washington Sta. Bul.* 165 (1921), pp. 69, figs. 11).—Studies begun in 1909 on the functions of sulphur in the soil in plant nutrition and on its use as a fertilizer are reported. An extensive historical review and a bibliography are included.

The studies included analyses of representative soils in the State of Washington and greenhouse and field experiments. The amount of sulphur contained in the surface 7 in. of the soils studied varied from 246 to 972 lbs. per acre. The amount found in virgin soils varied from 328 to 712 lbs. There seemed to be a more uniform distribution of sulphur in virgin than in cultivated soils. There was a tendency for the sulphur to concentrate in the surface of the bottomland soils.

In the greenhouse experiments the yield of dry matter obtained in a series of studies with quartz emphasized the importance of sulphur as a plant nutrient. The amount of sulphur contained in seed was found to be inadequate for plant growth, and when gypsum was included in the culture medium greatly increased yields were obtained.

Experiments with soil also showed the importance of sulphur as a plant nutrient, in view of the fact that the yields of dry matter obtained on soil treated with sulphur were on the average much larger than those obtained on untreated soil. Larger wheat and barley crops were obtained on the soil treated with sulphur than on untreated soil. In three out of four years oats and peas gave increases on treated soil, while soy beans yielded about the same on treated and untreated soils. The largest yield of alfalfa was obtained on untreated soil. Barley apparently derived the least benefit from sulphur treatment. Crops grown on treated quartz removed more sulphur than those grown on untreated quartz. Crops grown on both the treated and untreated soil removed more sulphur than those grown on treated quartz. Alfalfa utilized more sulphur than phosphorus and peas slightly more phosphorus than sulphur. Oats utilized more than three and a half times as much phosphorus as sulphur, wheat more than two and a half times as much, and barley more than one and a half times as much. It was observed that a crop with a low nitrogen content such as oats required more sulphur per pound of nitrogen than either barley or wheat. Alfalfa required more sulphur per pound of nitrogen than peas.

In the field experiments alfalfa plats treated with gypsum, acid phosphate, or sulphuric acid yielded two or more times the quantities obtained on land not treated with these fertilizers. Such increases were obtained on inoculated fields of alfalfa. Applications of hydrochloric and nitric acids in amounts

chemically equivalent to the sulphuric acid used showed no effects on growth. Elemental sulphur applications also increased the yields of alfalfa. Alfalfa grown on soils treated with sulphur was found to contain a higher percentage of protein than alfalfa from untreated soils. Cereals grown on land which had been in alfalfa were found to contain a high percentage of protein.

In studies of the influence of gypsum and other chemicals on soil it was found that the application of gypsum increased the nitric nitrogen over the amount found in untreated soil. It also slightly increased the solubility of the soil potassium, but the solubility of the soil calcium and phosphorus in its presence are regarded as negligible. The largest amounts of calcium were contained in the aqueous extracts from soil treated with either sulphuric acid, potassium sulphate, sodium nitrate, or nitric acid. Very little phosphorus was found in the aqueous extracts of the chemically treated soil. The largest amounts of potassium were found in the aqueous extracts of soil treated with sulphuric acid.

The influence of varying amounts of sulphur in the soil on crop yields, hydrogen-ion concentration, lime requirement, and nitrate formation, J. G. LIPMAN, A. L. PRINCE, and A. W. BLAIR (*Soil Sci.*, 12 (1921), No. 3, pp. 197-207, figs. 2).—In experiments conducted at the New Jersey Experiment Stations, barley and soy beans were grown on plats to which inoculated and uninoculated sulphur had been applied at rates of 200, 500, 1,000, 2,000, and 4,000 lbs. per acre.

The barley showed fair germination on all the plats, but as the season progressed there was evidence of injury with 1,000 lbs. and over of sulphur. Before harvest the plants on the plats that received 4,000 lbs. of sulphur had practically all been killed. With 200 and 500 lbs. of sulphur, germination and growth of the soy beans appeared to be about normal. With 1,000 lbs. and over germination was very materially depressed, there being very few plants on the plats that received 2,000 and 4,000 lbs. of sulphur.

Applications of 200 and 500 lbs. of sulphur did not very materially change the hydrogen-ion concentration throughout the season. Applications of 1,000 to 4,000 lbs. caused a decided increase in concentration after the fourth to eighth weeks. In most cases the highest concentration was reached toward the last of July or early in August. The minimum pH values noted were 3.5 and 3.6, both of these readings being obtained August 9.

Lime-requirement determinations were made on a limited number of the samples collected at intervals of about 6 weeks. From data thus obtained it was found that the 200 and 500 lb. applications of sulphur did not materially influence the lime requirement, but that the heavier applications did cause very decided increases. In most cases an increase in hydrogen-ion concentration was accompanied by an increase in lime requirement, but there was not a direct correlation. The work seemed to indicate the possibility of an approximate forecasting of lime requirement from the hydrogen-ion concentration, though the relationship differed with different soils and under different treatments.

The nitrates varied rather widely, apparently depending upon the crop growth. On an average they were higher on the check plats than on the treated plats. The lowest concentration of nitrates was noted near the end of July, soon after the barley had been harvested. Nitrates were found in considerable quantities in samples from those plats that showed the highest hydrogen-ion concentration. This is taken to indicate rather definitely that nitrification is not necessarily inhibited by a highly acid condition of the soil.

Solvent action of nitrification and sulfification, J. W. AMES (*Ohio Sta. Bul.* 351 (1921), pp. 223-257).—Studies of the solvent action of nitrification

and sulfonation on rock phosphate and soil minerals are reported. The influence of sulphur oxidized in soil on nitrification and ammonification was also studied. Several series of mixtures which included different treatments of soil, peat, and sand were used as media for determining the effects of sulfonation and nitrification under varying conditions. The soils used were an acid silt loam and a basic black clay. Casein, dried blood, and ammonium sulphate were the nitrogen carriers used.

It was found that approximately 50 per cent of the sulphur incorporated with soil at the rate of 0.5 gm. to 500 gm. of soil was changed to the form of sulphate. When a larger addition was made, 2 gm. of sulphur to 500 gm. of soil, 70 per cent was oxidized. While sulfonation was somewhat depressed in an acid soil by the addition of calcium carbonate, in sand mixtures the presence of calcium carbonate was essential. Oxidation of sulphur in soils devoid of basic calcium compounds depressed the activities of nitrifying organisms. Although basicity in excess of the requirement of the soil was supplied by calcium carbonate, nitrification was decreased by the oxidation of added sulphur. A further decided depression occurred with decreased basicity, so that there was a quantitative relationship between the amounts of nitrates found and the calcium carbonate additions.

The increasing quantities of ammoniacal nitrogen which accompanied the decreased amounts of nitrates when sulphur was oxidized are not considered to indicate a stimulating effect of sulfonation on ammonification. This inverse relation between ammonia and nitrates is attributed to a deficiency of the base necessary for neutralizing sulphuric acid.

In the absence of other bases the calcium of rock phosphate did not serve as a base for the sulfonating process to any appreciable extent. The proportion of rock phosphate to soil was such that phosphorus was added at the rate of 1,900 parts per million parts. The oxidation of sulphur incorporated with rock phosphate in the absence of calcium carbonate or nitrogen carriers changed 630 parts of phosphorus into a form soluble in neutral ammonium citrate solution. When calcium carbonate was added to the mixture prepared with an acid soil the oxidation of sulphur had practically no effect on rock phosphate.

In the basic soil the acidity resulting from sulfonation was partially neutralized by calcium naturally present as carbonate and in other combinations, so that the solvent action on rock phosphate was much less than that which occurred in the acid soil. Ammonium sulphate did not change the availability of rock phosphate to an appreciable extent. Whatever action ammonium sulphate had is attributed to the sulphate ion, rather than to biochemical action, since nitrification of ammonia did not occur in a soil deficient in bases unless calcium carbonate was added. Active nitrification of dried blood and ammonium sulphate occurred in the mixtures when conditions were favorable. Nitrification was stimulated by rock phosphate to a very limited extent.

Nitrification of dried blood, so far as availability was indicated by citrate solubility, was not an active agent for increasing the availability of rock phosphate mixed with soil. In the absence of rock phosphate or calcium carbonate the nitrification of dried blood as well as the action of ammonium sulphate, independent of the oxidation of its nitrogen, increased the concentration of water-soluble calcium. More calcium was taken into solution from the soil than from added rock phosphate. This is taken to indicate that the calcium of the soil is more readily attacked than rock phosphate by the process of nitrification. Nitrification of dried blood and oxidation of sulphur in soil mixtures increased the water-soluble potassium.

The liberation of potassium was brought about by salts formed rather than by the direct action of acidity on insoluble potassium compounds. Calcium

nitrate was present where nitrification was stimulated by calcium carbonate. Ammonium sulphate was formed by the reaction between sulphuric acid and ammonia from dried blood where a deficiency of basic calcium compounds restricted the nitrification of ammonia. Considerable amounts of calcium, aluminum, and manganese sulphates were also present in certain mixtures. Ammonium sulphate, independent of the ammonia being nitrified, affected the solubility of potassium.

Calcium naturally present in the soil as silicate and in other combinations was readily attacked by the acidity resulting from nitrification and sulfication. Ammonium sulphate was also an active solvent of calcium. Magnesium compounds were much less resistant to the action of these solvent agencies. Large quantities of aluminum and manganese were converted into soluble forms where sulphur was oxidized in the acid silt loam soil. Small amounts of these elements were made soluble by this action in the basic clay. Nitrification had no effect on aluminum.

[Fertilizer analyses], R. E. ROSE and F. T. WILSON (*Fla. Dept. Agr. Quart. Bul.*, 29 (1919), No. 1, pp. 86-123).—This section of this report contains the results of analyses of 406 special samples and 35 official samples of fertilizers and fertilizer materials collected for inspection or sent in by purchasers in Florida during the last quarter of 1918.

The American fertilizer handbook (*Amer. Fert. Handb.*, 14 (1921), pp. [514], figs. 49).—This number of this handbook contains the usual directories of fertilizer manufacturers and allied fertilizer trades, and data on the production, sale, and use of phosphate rock, sulphuric acid, acid phosphate, and other fertilizer materials.

1921 yearbook of commercial fertilizer (*Yearbook Com. Fert.*, 1921, pp. 220, figs. 20).—This issue of this publication contains the usual classified directories of fertilizer manufacturers and allied trades, cottonseed oil mills, agricultural experiment stations, and officials in charge of State fertilizer laws, together with a number of special articles on subjects relating to the manufacture, purchase, and use of commercial fertilizers.

AGRICULTURAL BOTANY.

Hybridization of spontaneous variants, C. FRUWIRTH (*Ztschr. Pflanzenzücht.*, 7 (1919), No. 1, pp. 66-73, figs. 2).—Studies carried out with *Lupinus angustifolius* led to the general conclusion that in crossing a spontaneously appearing variety with its descendant forms deviations frequently occur as regards dominance and splitting.

Attempts to hybridize *Pisum* and *Faba*, S. BACH (*Ztschr. Pflanzenzücht.*, 7 (1919), No. 1, pp. 73, 74).—Failures to obtain crossings between *Pisum* and *Faba* are thought to have been due possibly to lack of special chemical stimulation.

Datura—an inviting genus for the study of heredity, W. E. SAFFORD (*Jour. Heredity*, 12 (1921), No. 4, pp. 178-190, figs. 7).—This includes discussion, more or less descriptive, of a number of *Daturas*, including some tree forms thought to be suitable for heredity studies.

Chromosome relationships in wheat, K. SAX (*Science, n. ser.*, 54 (1921), No. 1400, pp. 413-415).—The author reports that einkorn possesses 7 haploid chromosomes; the emmer group, consisting of *Triticum dicoccum*, *T. durum*, *T. turgidum*, and *T. polonicum*, has 14 haploid chromosomes; and the vulgare group, consisting of *T. vulgare* and *T. compactum*, has 21 haploid chromosomes.

A study of the sterility relationships of species crosses has shown that einkorn crossed with members of the emmer group or with members of the vul-

gare group resulted in almost totally sterile F_1 plants. Members of the emmer group crossed with members of the vulgare group resulted in only partially sterile F_1 individuals, while species within each group were interfertile.

The genus Septoria, presented in tabulation with discussion, P. GARMAN and F. L. STEVENS (*Ill. State Acad. Sci. Trans.*, 13 (1920), pp. 176-219).—On account of the helpfulness of a simple method of listing species as a basis for studies in morphology and as a means for rapid determination of fungi, the authors have listed in tabular form the species of *Septoria* described in Saccardo's *Sylloge Fungorum*, vols. 1-22, giving the more important morphological characters together with a list of host plants and localities from which the species are reported. The family of each host genus has been given a number and added to the list.

The use of agar slants in detecting fermentation, H. J. CONN and G. J. HUCKER (*New York State Sta. Tech. Bul.* 84 (1921), pp. 3, 4).—In a previous publication (E. S. R., 42, p. 325), a description was given of the use of agar slants for detecting acid production by two soil organisms. The continued use of this method has shown that it has had the decided advantage of showing acid production after a very brief incubation, sometimes in a few hours only.

A modification and new application of the Gram stain, G. J. HUCKER (*New York State Sta. Tech. Bul.* 84 (1921), pp. 7-9).—A modified method of the Gram stain is described for use in staining milk smears that is said to have been very satisfactorily used in the examination of milk samples.

Rose bengal as a general bacterial stain, H. J. CONN (*New York State Sta. Tech. Bul.* 84 (1921), pp. 5, 6).—Very satisfactory results are said to have been secured with this stain on account of its great affinity for bacterial protoplasm, but not for the slime or debris surrounding the cells.

Mold hyphae in sugar and soil compared with root hairs, M. B. CHURCH and C. THOM (*Science*, n. ser., 54 (1921), No. 1402, pp. 470, 471).—The authors call attention to the similarity of the development of mold hyphae in sugar and in soils with the growth of root hairs of plants, and they refer to the difficulty of recognizing either in the substratum where they are grown. The intimate relationship between mold hyphae and the substratum is said to explain why many investigators have overlooked active growth of mold in the soil. It is also said to explain in part the spoilage of certain foodstuffs such as sugar.

Osmotic pressure, root pressure, and exudation, V. H. BLACKMAN (*New Phytol.*, 20 (1921), No. 3, pp. 106-115, figs. 3).—An attempt has been made to show that the claim of Lepeschkin, that the osmotic pressure of the stronger cell contents is responsible for the exudation from the cell of a weaker solution, can not be substantiated. Other mechanisms can be suggested, but it is thought that much more knowledge of cell dynamics is required before it will be possible to deal satisfactorily with such problems as exudation and root pressure.

The mechanism of root pressure, J. H. PRIESTLEY (*New Phytol.*, 19 (1920), No. 7-8, pp. 189-200, figs. 2).—The author presents mainly in the present article, according to his own conception, evidences in the form of data drawn chiefly from the work of other investigators, attempting an explanation of the mechanism of root pressure in accordance with experimental evidence and chemical and physical laws. The work now in progress, following out the views here stated, is said to have shown support without conflict as regards such views and conclusions.

Osmosis is regarded as obviously of primary importance in connection with the process by which sap is driven up the xylem from the roots, and an at-

tempt is made to estimate the significance of osmosis in this process. The author formulates (and discusses in some detail), from data presented, his hypothesis intended to overcome difficulties apparently involved in the passage of water from the cells bordering on xylem vessels into such vessels.

Capillary processes in living cells, A. NATHANSOHN (*Kolloidchem. Beihefte*, 11 (1919), No. 10-12, pp. 261-321).—The author has undertaken to present in outline the double rôle which, on the basis of the theory of electrolytic respiration, should be ascribed to capillary-electric processes in physiological oxidation and in the transformation of energy.

The concentration of hydrogen ions in the soil, C. OLSON (*Science*, n. ser., 54 (1921), No. 1405, pp. 539-541).—An account is given of investigations carried on to determine the importance of the concentration of hydrogen ions with regard to the natural distribution of the plants. It was found that many species of plants occur only on soils where the concentration of hydrogen ions is within a certain range characteristic for each single species. Within this concentration another range was observed, within which the species has its largest average frequency. As a result of these studies it is held that it is possible to judge of the concentration of hydrogen ions in the soil from the constitution of the plant formations, when they do not consist of too few species.

The field observations reported upon were checked by water culture experiments which proved that species found only on very acid soils showed their strongest growth in culture media with pH values near 4, while species naturally grown in alkaline soils have their strongest growth in culture media the pH values of which are between 6 and 7. An investigation was made on the availability of different forms of nitrogen, and it was found that nitrogen from ammonia and from nitrate nitrogen was of the same value for acid soil plants and for basic soil plants, when the plants were cultivated at constant concentrations. On the other hand, if the pH value was not constant, the plants made the solution more acid when ammonia was a source of nitrogen. In this case basic soil plants soon die, because the solution becomes too acid. Acid soil plants last longer, as they are more tolerant. If the source of nitrogen is a nitrate (nitrate of ammonia excepted), the plants make the solution more alkaline and the plants die, after having first become chlorotic.

The author believes the investigations prove that the quantity of nutritive substances does not largely influence the distribution of plants. This is said to be contrary to the results obtained by other investigators, who consider that acid soils are poor and the neutral and basic soils rich in such substances.

Topographic relief as a factor in plant succession, G. D. FULLER (*Ill. State Acad. Sci. Trans.*, 13 (1920), pp. 243-247).—Great differences in the rate of succession in certain areas indicated are thought by the author to have been due largely to differences in the topography relief of the areas.

Note on an improved method for demonstrating the absorption of oxygen in respiration, A. W. BARTLETT (*New Phytol.*, 19 (1920), No. 5-6, pp. 151, 152, figs. 3).—The author presents, with explanation, a modification of the apparatus which is usually employed for demonstrating the removal of oxygen from the air by germinating seeds. This apparatus in its present form is claimed to show adequately (without manometer effect) the true amount or degree of utilization of oxygen by the germinating seeds.

The permeability of citrus leaves to water, F. T. McLEAN (*Philippine Jour. Sci.*, 19 (1921), No. 1, pp. 115-123, fig. 1).—On account of the possible relation, both to waterlogging and to disease admittance, of resistance of leaves to penetration by water, the author has undertaken to ascertain what pressures

are necessary to cause infiltration of water through the stomata of citrus leaves. A satisfactory method of manipulation and of observation is described as effective in determining the pressure required to force water through the stomata of the leaves.

The pressure required to inject leaves of a given variety seems to vary greatly with the treatment before testing, appearing to be lowest in case of leaves exposed to bright diffused light and well supplied with moisture. Apparently Szinkom mandarin orange leaves require on the average more than twice as much pressure to inject them with water as is required for leaves of Pernambuco grapefruit, this fact appearing to be correlated with the average width of the stomatal aperture through the epidermis.

The significance of calcium for higher green plants, R. H. TRUE (*Science*, n. ser., 55 (1922), No. 1410, pp. 1-6).—In an address before the botanical section of the American Association for the Advancement of Science at its meeting in December, 1921, the author reviewed the work of himself and others on the function of lime as related to growth of the higher green plants. Experiments cited indicated that calcium has a protective function in preventing the solution of cell walls and also in rendering them less permeable to other ions.

The author concludes that a certain quantity of calcium ions must be present in the medium for the maintenance of the chemical and functional integrity of the cell wall, as well as the chemical integrity of the deeper lying living parts of the cells of absorbing roots of higher green plants. When this is so maintained, absorption takes place in the manner usually considered normal. When the necessary minimal supply is lacking, absorption is upset and a more or less marked leaching of the ions from the plant follows. In the absence of the necessary minimum of calcium ions, the soil solution or culture solution may be rich in all other required ions, but these are useless to the plant as they are unabsorbable. This leads to the conclusion that calcium ions make physiologically available other equally indispensable nutrient ions.

The quantitative basis of the polar character of regeneration in Bryophyllum, J. LOEB (*Science*, n. ser., 54 (1921), No. 1404, pp. 521, 522).—The author has investigated the question as to why in the case of defoliated stems of *B. calycinum* all the nodes, except the apical ones, fail to produce shoots in the case of long stems, while they will produce shoots if the stems are cut to single nodes.

In the course of the investigation it was found that the mass of the two shoots produced at the apex of a long piece of stem equals approximately the mass of shoots which would have been produced in the same stem in the same time under the same conditions if the shoots could have grown out in all the nodes. This is said to leave no doubt that the polar character of the regeneration of shoots is due to the fact that all the material available for growth reaches the apical and none of the other nodes of a long piece of stem.

Factors for anthocyanin formation in Pisum, S. BACH (*Ztschr. Pflanzenzücht.*, 7 (1919), No. 1, pp. 64-66).—Two color factors appear to be present in blooms of *Pisum* colored with anthocyanin.

A study of the pollen and pistils of apples in relation to the germination of the pollen, J. N. MARTIN and L. E. YOCUM (*Iowa Acad. Sci. Proc.*, 25 (1918), pp. 391-410, figs. 4).—The work reported in this paper was intended to determine the content of the pollen; to investigate the germination of the pollen in solutions and on membranes with a view to discovering the germination requirements; to determine the effects of different temperatures, of age, and of drying on the germination; and to determine the structure and content of the stigma and style, whether or not secretions are present on the stigma, and the behavior

of the stigma with reference to the germination of the pollen. These investigations were expected to give some information concerning the effect of rainy weather during the blooming period on the setting of fruit; the condition of the stigma at the time horticulturists regard it as receptive; the time at which artificial pollination can be done most successfully; and whether or not the bagging of flowers has any effect upon results of pollination due to increasing the moisture content of the air about the flowers.

The pollen of the five varieties of apples studied contained proteins or amino acids, some pectin, and occasionally small amounts of sugar at the time of pollination. The walls were composed of cellulose and pectin. In the early bud stage there was much starch present. The ability to absorb water varied much for different pollen grains, but most of them remained plasmolyzed in 55 per cent cane sugar solution.

The concentrations of cane sugar solutions suitable for germination varied much for different pollen grains, ranging from 0 to 70 per cent, the most favorable being 2.5 per cent. The pollen could germinate in any concentration from which it could absorb sufficient water. As the length of the germination period increased in the higher concentrations the percentage of germination and length of tubes increased. The sugar was found to serve only in controlling water absorption, better germination and tubes fully as long being obtained when the pollen was germinated on animal membrane. The conditions required for germination were the same for all of the five varieties. Temperatures from 22 to 25° C. were the ones most favorable to germination, which was slowed by lowering the temperature. Apple pollen is very resistant to cold, suffering no apparent injury from freezing. Pollen from flowers stored in paper bags was all dead at the end of 18 days.

A phenological study, F. DARWIN (*New Phytol.*, 18 (1919), No. 9-10, pp. 287-298).—Data are presented in tabular form, with discussion, as obtained from observation of the flowering dates of the commoner plants near Brookthorpe, Gloucestershire, during the period 1917-1919. These data are accompanied by records for that period of weekly normal temperatures as one of the main elements influencing the date of flowering. Weekly deviations from the normal are also given, being regarded as of even more importance than normal temperatures on flowering time.

Studies in phenology, II, F. DARWIN (*New Phytol.*, 20 (1921), No. 1, pp. 30-38).—Observations formerly made at Brookthorpe, as above noted, have been continued, and to this work have been added observations made at Cambridge and near Gomshall in Surrey, the results being expressed in tabular form. The fact that spring flowering occurred early in 1918 and 1920 appears to be connected with relatively high temperatures.

Horticultural smoke injury, A. JANSON (*Samml. Abhandl. Abgase u. Rauchschäden*, No. 11 (1916), pp. 59, figs. 11).—Injury to trees from gases, more apparent in the foliage, is attributed mainly to sulphur dioxide (forming sulphuric acid) from large scale combustion of coal. This account records the results of observations, including lists of species most injured, effects of air currents, deflecting obstacles, distance, and other factors.

FIELD CROPS.

[Report of work with field crops in Kansas, 1919-1920] (*Kansas Sta. Rpt.* 1920, pp. 15, 16, 19, 20, 42, 45).—The progress of crop investigations is described in continuation of similar work (*E. S. R.*, 44, p. 224).

During the 9-year period ending with 1919, Kanred, Turkey, and Kharkof wheat averaged 27.3, 23.2, and 23.3 bu. per acre, respectively, in the variety

tests at the station, and in the last 4 years at Hays, 23.9, 19.1, and 22.1 bu., respectively. Wheat seeded in furrows for 10 years at Manhattan, for 2 years at Colby, and 2 years at Hays outyielded that seeded by the ordinary method by 0.6, 4.5, and 2.5 bu. per acre, respectively. Where the furrows extended north and south the yields were usually somewhat higher than in furrows extending east and west. Tests at Hays indicated that October 1 is the optimum date for seeding winter wheat on a well prepared seed bed. Little difference in yields was secured by seeding wheat at rates from 3 to 4 pk. per acre, except in seedings later than October 15, when the 4-pk. rate gave the best returns.

Kanota oats (E. S. R., 45, p. 738) yielded 54.3 bu. per acre in 1919 as compared with 33.2 bu. from Red Texas and 50.2 bu. from Iowa No. 103.

The results of State-wide cooperative variety, fertilizer, and rotation tests with cereals showed Kanred to outyield Turkey and Kharkof by about 4 bu. per acre throughout the hard-wheat section for the fifth consecutive season. Kanota oats averaged 45.2 bu. per acre, while local Red Texas gave but 29.9 bu. Application of 150 lbs. of bone meal increased the wheat yield an average of 6.7 bu. in eastern Kansas, while potash and blood meal had very little effect. In central Kansas wheat did not respond to commercial fertilizers with increased yields. Results show that either manure or acid phosphate can be used to good advantage on alfalfa in the eastern third of the State.

A comparison of different methods of corn cultivation continued for 5 years at the station showed no significant difference in yields, the results indicating that the principal object of cultivating corn is the control of weed growth.

Alfalfa cut for hay at four stages of maturity, bud, one-tenth bloom, full bloom, and seed formation averaged 3.43, 4.03, 4.08, and 3.69 tons per acre during the 6-year period ended with 1919.

Leading varieties at Colby included Sherrod White Dent corn with 48.8 bu., Sumac sorgo with 22,550 lbs., Kanred wheat with 28.4 bu., and Coast barley with 26.2 bu. per acre.

Dwarf Yellow milo proved to be the most reliable grain sorghum variety for the region around Garden City, while Dwarf Blackhull kafir and the sweet sorgos were found best for silage. Rate-of-irrigation experiments indicated that water can be used most profitably in this region on such crops as milo, kafir, and the sorgos. In ordinary years, small grain crops use large quantities of irrigation water less efficiently than the sorghums.

[The Woburn field experiments, 1920], J. A. VOELCKER (*Jour. Roy. Agr. Soc. England*, 81 (1920), pp. 253-267; also in *Woburn Expt. Sta. Rpt. 1920*, pp. 3-17).—The progress of the experiments with field crops is described as heretofore (E. S. R., 44, p. 525). The season of 1919-20 was considered distinctly unfavorable.

The highest grain yields in the continuous wheat experiments were 19.5 bu. with 1,510 lbs. of straw from the plat receiving mineral manures with sulphate of ammonia and lime, and 19.4 bu. and 1,864 lbs. of straw from the plat receiving mineral manures with nitrate of soda. The untreated checks averaged 8.5 bu. of grain and 784 lbs. of straw. Mineral manures alone returned 9.9 bu. of grain and 1,082 lbs. of straw. The addition of mineral manures to 25 lbs. of nitrogen in the form of nitrate of soda produced a gain of 3.1 bu. of grain, but double dressings of nitrate of soda gave returns inferior to those yielded by single dressings. Rape dust when applied at the time of seeding produced 16.6 bu. of grain and 1,592 lbs. of straw, equaling the grain yield produced by the application of farmyard manure, but with 434 lbs. less straw. Phosphates without potash, and potash without phosphate, returned practically equal amounts of grain and straw.

As in the previous year, farmyard manure produced the maximum yield in the continuous barley experiments, 33.4 bu. of grain and 2,908 lbs. of straw, and this was followed by the plat receiving nitrate of soda with sulphate of potash, which gave 25.2 bu. of grain and 1,966 lbs. of straw. The untreated plats averaged 7.5 bu. of grain and 714 lbs. of straw per acre. Mineral manures alone gave 15.7 bu., whereas, contrary to the results of previous years, they returned only 9.7 bu. where lime had been added in 1915. The returns from the sulphate of ammonia plats indicated the need of more lime. Apparently, barley on the land in the experiments requires more frequent applications of lime than does wheat. Nitrate of soda alone gave but 6.3 bu. of grain, while with the addition of minerals 17 bu. was secured, and doubling the amount of nitrate of soda used with the minerals gave 19.8 bu. per acre. The use of sulphate of potash with nitrate of soda gave 7.1 bu. more than was obtained with superphosphate. Though also applied at the time of seeding, rape dust did not effect the same improvement as was shown with wheat, the yield being only 12.2 bu. Taken together with the differences exhibited with potash and phosphate, this would seem to indicate some clear diversity in the respective abilities of wheat and barley to utilize different fertilizing materials.

In comparisons of the effect of the unexhausted residues from cake and grain feeding on rotation plats, no appreciable difference was shown in favor of either grain or cake on the yield of red clover hay after barley. Wheat after red clover produced 27.1 bu. of grain on the cake plat and 26.6 bu. on the grain-fed plat. However, the wheat grown in this rotation was 7 bu. per acre better than the highest produced, either fertilized artificially or with farmyard manure, in the continuous wheat-growing series in the same field.

In improvement work with old pastures, the heaviest yield, 3,864 lbs., was secured from the plat receiving 12 tons of farmyard manure, and the plat receiving an application of 10 cwt. of basic slag and 3 cwt. of kainit was next with 3,332 lbs. of hay of better quality. The untreated check produced 2,548 lbs. An unlimed plat was best and a plat receiving magnesium lime was poorest in a comparison of various kinds of lime for grassland. Ground lime and ground chalk showed their superiority in tests of different forms of lime.

Review of [Danish] State experiments in plant culture for the fiscal year 1921-22 (*Tidsskr. Planteavl*, 27 (1921), No. 4, pp. 600-616).—A brief review is given of the different projects in plant culture pursued by the Danish experiment stations. Some of the projects enumerated are conducted co-operatively in two or more different localities. A brief description of the stations is included in the article.

[Report of field crops work in Mesopotamia in 1920], R. THOMAS ET AL. (*Mesopotamia Dept. Agr. Admin. Rpt. 1920*, pp. 6-10, 31-33, 34-37, 45, 47, 48, 51, 52, 57-65).—In continuation of earlier work (E. S. R., 44, p. 527), these pages describe cultural, variety, and irrigation tests with cotton (E. S. R., 44, p. 435) and wheat and barley (E. S. R., 44, p. 232) and variety tests with flax for fiber and seed, peanuts, and miscellaneous field crops. Cultural methods involved in the production of barley, wheat, rice, corn, field beans, and vetch in the Tigris-Euphrates Valley are outlined, together with considerable information on the extension of the cotton industry in the region.

[Report of field crops work in the Central Provinces and Berar, India, 1919-20], S. T. D. WALLACE ET AL. (*Cent. Provs. and Berar [India] Dept. Agr., Agr. Stas. South. Circle Rpt. 1920*, pp. 1, 2, 3-13, 15, 18-26, 31-41, 43-45, 47-55, 62, 63; *West. Circle Rpt. 1920*, pp. 3-19, 27; *North. Circle Rpt. 1920*, pp. 44-15, 17, 21-23, 30, 31, 33-41, 45-47, 58-60, 63, 66, 67, 71-73, 79, 80; *Expt. Farm. Agr. Col., Nagpur, Rpt. 1920*, pp. 6-15; *Agr. Col., Nagpur, Bot. and Chem. Research [etc.], Rpt. 1920*, pp. 15-17).—Continuing previous work (E. S. R., 44,

p. 632), these pages describe the progress of cultural, variety, rotation, and fertilizer tests with rice, wheat, jowar, sugar cane, gram, cotton, and miscellaneous field crops.

[**Report of field crops work in Nigeria, 1920-21**], P. H. LAMB and T. THORNTON (*North Provs., Nigeria, Agr. Dept. Ann. Rpt. 1920-21*, pp. 2-6, 9, 10, 13-17).—The progress of experiments with various field crops is described as heretofore (E. S. R., 44, p. 433), for the period January 1, 1920, to March 31, 1921, inclusive.

The genetic basis for improvement in self-fertilized crops, R. A. BRINK (*Sci. Agr.*, 2 (1921), No. 3, pp. 83-87, fig. 1).—In this article the author traces the development of genetic thought as it has affected breeding practice with autogamous plants, and calls attention to a property of populations of pure lines.

In populations consisting of pure lines having different yield values, those strains exhibiting the lower capacities in this respect tend to become automatically eliminated. The greater the difference in yield the more rapidly will this elimination proceed. "Although it has been a matter of common knowledge among agronomists that mixtures of oats and barley, for instance, fail to maintain their original proportions on being grown from seed mixtures taken from successive crops, this property of pure line populations has not been previously emphasized as a self-regulating factor in maintaining the original qualities of a superior strain when degressive mutations take place."

Permanent meadows in Denmark, their importance, establishment, maintenance, and use, E. TOFTEMARK (*Varige Graesgange i Danmark. Deres Betydning, Anloeg, Vedligeholdelse og Benyttelse. Copenhagen: August Bangs, 1921*, pp. 95).—A prize essay published in pamphlet form, treating of the history of permanent meadows in Denmark, their advantages and importance, general requirements, establishment on different soil types, and their care, maintenance, and use.

Meadows (*Illus. Landw. Ztg.*, 41 (1921), No. 79-80, pp. 345-358, figs. 18).—This number comprises the following articles: General Measures for the Improvement of Forage Culture, by W. Freckman; Modern Meadow Problems, by U. von Brandis; Nitrogenous Fertilizers for Meadows, by P. Wagner; The Characteristics of German Meadows, by Raum; The Relation of Meadow Improvement to Intensive Agriculture, by Hambloch; Dry Upland Meadows and Their Management, by Hardt; The Meadow and its Possibilities, by Breithaupt; Advantages of Irrigated Meadows, by F. Mankiewicz; Droughts and Meadow Irrigation, by Heimerle; Drainage of Meadows and Pastures, by M. Scheibe; The Value of City Waste Water for Meadow Irrigation, by A. Kreuz; and Improvements in Hay Loaders, by F. Foedisch.

Improving old pastures, E. G. MONTGOMERY (*N. Y. Agr. Col. (Cornell) Ext. Bul. 46* (1921), pp. 35-52, figs. 6).—This publication discusses past and recent methods of improving old pastures, indicates grasses and mixtures for different soil types and conditions, and includes notes on the cost of the pasture land, value of pasturage in terms of feed, temporary pastures, and soiling crops.

Spring grain—culture, varieties, yields, M. E. MCCOLLAM (*Washington Sta., West. Wash. Sta. Bimo. Bul.*, 9 (1922), No. 6, pp. 85-87, figs. 3).—Cultural directions based on experiments in progress at the station are given for spring oats, barley, and wheat. The highest yields were obtained by seeding 120 lbs. of oats, 150 lbs. of wheat, and 120 lbs. of barley per acre. February or early March was found to be the most desirable time for spring seeding of either of the three crops. In tests of oat varieties on upland "shot clay" soil, Banner, Minnesota No. 281, and Sparrowbill led with 57.3, 56.8, and 56.1 bu. per acre, respectively.

Hannchen barley averaged 36.9 bu. per acre, and Pacific Bluestem, with 27.3 bu., and Red Chaff Club, with 25.6 bu. per acre made the best yield records of the spring wheat varieties tested.

The influence of time of seeding on the protein content of the barley kernel, FRIEBE (*Fühling's Landw. Ztg.*, 70 (1921), No. 15-16, pp. 296-307).—Hanna, a mutant barley, and Goldthorpe, an upright sort, were planted on four successive dates on sand, loam, and clay soils. Analyses of the crops from the plantings on loam disclosed percentages of crude protein in kernels of Hanna as follows: March 25, 10.4; April 3, 10.9; April 19, 11.8; and May 8, 14.1. Corresponding plantings of Goldthorpe contained 9.1, 10.6, 12, and 16.8 per cent, respectively. A similar trend was also noted on both sand and clay soils.

The shorter growing season, smaller yield, lower quality, and higher protein content characterizing the late seedings demonstrated the value of early seeding of barley intended for brewing purposes. This behavior is held applicable to all varieties of *Hordeum distichon* and probably to other species of barley.

The dominant Mendelian characters in barley breeding, J. G. C. FRASER (*Sci. Agr.*, 2 (1921), No. 4, pp. 113-116, fig. 1).—The results of European and American work in barley breeding are presented in summary form, together with a tabulation of the dominant Mendelian characters of barley so far as determined.

Variation and inheritance in red clover, M. O. MALTE (*Sci. Agr.*, 2 (1921), Nos. 3, pp. 79-83; 4, pp. 125-132; 2 (1922), No. 5, pp. 157-162).—A synopsis is given of the outstanding results obtained from investigations with red clover in Europe and North America, together with a list of 53 titles. The principal findings can be summarized as follows:

Red clover is self-sterile, cross-fertilization being required to obtain germinable seed. While the crop is very variable in respect to morphological characters, the several forms may be arranged in two rather distinctly defined groups: European red clover, with smooth or appressed hairy stalks, and American red clover, spreadingly hairy on the stalks. The various types may be classified as types blossoming comparatively early and capable of producing two full crops of hay in a season, and types blossoming from one to several weeks later than the early ones and producing only one full hay crop in a season. Many local varieties exist which differ considerably in respect to botanical characteristics and agricultural value.

Presence of leaf markings is dominant over absence, and central markings appear to be dominant over basal ones. Varieties lacking the usual markings and therefore with all-green leaves have been developed. Polyphyly is hereditary, and varieties characterized by a large percentage of polyphyllous plants can be developed. Whether polyphyly shall be regarded as an atavistic phenomenon or as a form of fasciation is considered as yet open to question. White blossomed forms are well known, but blue-flowered red clover types are very rare. The red-flower color, probably determined by two or more Mendelian factors, is dominant over white and blue. As white-flower color is a recessive character it is comparatively easy to develop constant white-blossomed varieties, and for the same reason blue-blossomed varieties.

All mature seeds in given red-clover plants are of the same color type, but great differences in respect to the seed color exist between different individual plants. Seed color is hereditary, dark purplish being dominant over light purplish and pink, and both dark and light purplish dominant over yellow. Varieties having a distinct seed color, or at least with a certain color type predominant, can be developed. The 1,000-seed weight as found in individual plants varies greatly, extremes of 1.18 and 3.1 gm. being recorded.

The existence of correlation between time of development and color of flowers is considered very doubtful. No fixed correlation occurs between color of flowers and color of seed, except perhaps in the case of blue-flowered types. No correlation exists between color and weight of seed or between color of seed and the agricultural value of plants developed from the seed. Light-colored and dark-colored seed may each produce either poor or valuable plants, demonstrating that the inherent value of red-clover seed can not be judged from its color. The author concludes that the inherent value of red-clover seed depends more on its pedigree than on other factors.

Some observations on the growth of maize in Egypt, J. A. PRESCOTT (*Sultan. Agr. Soc., Tech. Sect., Bul. 7 (1921), pp. 25, figs. 13*).—Observations on the growth of individual corn plants were made with an auxanometer registering the growth trace for two or three day periods; by daily measurements during the total growth period; and at weekly intervals on plants sown April 1, May 1, and June 1, and every two weeks thereafter until the end of September.

There are two maxima during the 24 hours' growth. At no time does the maize plant stop growing altogether, but usually at daybreak there occurs a slight decrease in the height, probably associated with the opening of the stomata and the loss of water due to the resumption of daytime transpiration. A rapidly increasing rate of growth follows until the hotter part of the day is reached, when a slight retardation is usually observed. In the late afternoon an acceleration again gives a new maxima about sunset. During the night the growth rate falls off gradually to the minimum just before sunrise.

Temperature is considered the probable controlling factor during the early morning, late afternoon, and night, while during the hottest part of the day water strain becomes the limiting factor due to the inability of the soil to supply water fast enough to cope with the transpiration of the plant. After each application of irrigation water a marked increase in growth rate appears which probably masks entirely any possible effect on the daily growth due to the relative humidity of the atmosphere. A fairly close relationship also exists between the temperature and the growth rate in the early part of the season when soil moisture is abundant, but is likewise masked as the plant becomes older and soil moisture conditions intervene.

A greater number of irrigations than customary were required when the approach of the soil moisture content to 25 per cent at a depth of 20 to 40 cm. was made the criterion. The slight increase thereby obtained in the final yield became more marked with heavy fertilizing. An increase in the height of plants also accompanied the more frequent irrigations.

Corn seeded in April, May, and July required 12, 10, and 5 to 6 days, respectively, for germination. The most rapid rates of growth, leaf development, tasseling, silking, and maturation and the highest yield took place in the seeding made July 13.

Improvements in cotton production, O. F. COOK (*U. S. Dept. Agr., Dept. Circ. 200 (1921), pp. 12*).—An account of the results of cotton improvement studies in progress since the advent of the boll weevil (*E. S. R.*, 27, p. 640). Superior varieties, desirable cultural characters, and characters that facilitate picking are described, with notes on the value of short-season varieties, the advantages of small early plants, and the suppression of vegetative branches (*E. S. R.*, 42, p. 136). The author outlines the improvement of the quality and uniformity of fiber, adaptation to new and to special conditions (*E. S. R.*, 26, p. 41; 28, p. 833; 29, p. 140; 40, p. 237), and the improvement of the seed supply (*E. S. R.*, 30, p. 138; 33, p. 833), and relates the merits of one-variety communities and the advantages accruing from improvement of community organization

(E. S. R., 27, p. 533) and of the commercial system (E. S. R., 42, p. 339; 44, p. 138).

Para and Paspalum: Two introduced grasses of Guam, G. BRIGGS (*Guam Sta. Bul. 1* (1921), pp. 44, pls. 6).—Detailed information is presented concerning the characteristics, propagation, management, renovation, fertilizing, treatment, and feeding of Para (*Panicum barbinode*) and Paspalum (*P. dilatatum*) grasses, with data relative to the cost of establishing improved pastures, based on the results of planting, cultural, and fertilizer tests (E. S. R., 28, p. 136; 45, p. 33), feeding trials (E. S. R., 35, p. 869; 40, p. 366; 42, p. 64; 45, p. 70), and various analyses. The environmental conditions at Guam are outlined, with brief notes on sword grass (*Miscanthus floridulus*), and awn grass (*Andropogon aciculatus*).

Experience with native grasses in 10 years' live-stock work by the station showed the desirability and necessity of substituting for them proved introduced grasses, such as Para and Paspalum. Both of these perennials are adapted to Guam conditions, being remarkably vigorous growers during the wet season, and, on the other hand (particularly Paspalum grass), possessing special drought-resistant qualities which render them valuable during periods of extremely dry weather.

Para grass was introduced into Guam by the station in May, 1910, from the Hawaii Station, where it had been brought from the Fiji Islands in 1902. This grass gives high yields on lowlands, the yields being increased by applications of barnyard manure or commercial fertilizer. In palatability tests the animals preferred Para grass to the other grasses tried at the station.

Paspalum grass was introduced into Guam in 1909 by the station, seed being obtained from the U. S. Department of Agriculture. It is principally a pasture grass, producing a large amount of pasture during at least nine months of the year, and on the better soils it will support several times as many cattle as the native grasses. It is adapted to a wider range of soil conditions than any other grass tested by the station, growing best on the rich, moist lowlands, but also succeeding on comparatively poor and rocky soils.

Both Para and Paspalum grasses should be well established before they are pastured. While Paspalum grass will stand much heavier grazing at all times than will Para grass, the latter will easily carry one animal per acre the year round. The analyses and feeding and pasture tests show both grasses to possess a high content of protein and fat and a high feeding value.

The pigeon pea (*Cajanus indicus*): Its culture and utilization in Hawaii, F. G. KRAUSS (*Hawaii Sta. Bul. 46* (1921), pp. 23, pls. 5, fig. 1).—The origin, characteristics, and varieties of the pigeon pea are discussed and its soil and climatic adaptations noted. Cultural and harvesting practices employed in the production of seed and hay in Hawaii are outlined in detail, and the utilization of the crop for feed, green manure, as a cover crop, and in rotations is described. The feeding value and milling and mixing of feeds are treated briefly, together with suggested feeding rations having a base of pigeon-pea products. A section on insect pests is included.

The influence of nutrients on the quality of potatoes, A. KRAFT (*Arb. Forschungsinst. Kartoffelbau, No. 3* (1920), pp. 73).—Different potassium, nitrogen, phosphorus, and calcium compounds and stable manure, alone and in combinations, and green manures were applied to potatoes on a sandy loam soil.

The effects of potassic and nitrogenous fertilizers were much more obvious than those of phosphorus and calcium. Potassium fertilizers alone heavily depressed the dry matter, starch, and protein content of the tubers, increased the percentage of water and mineral matter, and had an unfavorable influence on

the flavor, the 40 per cent salt exceeding kainit in its effects. Omission of potassium from fertilizers increased the dry matter, starch, and protein, and reduced the water and ash content.

Nitrogenous salts alone increased the protein and depressed the ash and crude fiber. Omission of nitrogen from the fertilizer reduced dry matter, starch, and protein, increased the percentage of minerals, and was accompanied by a strong scab infection not present with an adequate nitrogen supply. Lime nitrogen proved superior to ammonium sulphate in the trials.

Phosphorus salts alone differed considerably in their effects. Thomas slag producing the highest content of dry matter and starch of all the materials used in the experiments, together with a very high percentage of protein; whereas superphosphate reduced the protein about 50 per cent. In its effects, bone meal occupied an intermediate position among the various fertilizers. Differences in availability of the phosphoric acid and in the amount and form of calcium present are suggested to account for the varied effects of the phosphorus fertilizers.

The use of green manures and stable manure favored a high quality of tuber.

Rice Millers' Association statistical reference book, compiled by F. B. WISE ([*New Orleans*]: *Rice Millers' Assoc.*, [1920], pp. [31], figs. 13).—The tabulations included in this folio show yields per acre, acreage, distribution, and receipts of rice by States in the United States; production of rice in the United States from 1821 to 1920, inclusive; shipments to Porto Rico by months; the world's rice acreage and production by countries; average price and quantity of rice imported into and exported from the United States; quantity of foreign rice in American warehouses; and stocks of rough and clean rice in New Orleans and mills.

Sudan grass and related plants, H. N. VINALL and R. E. GETTY (*U. S. Dept. Agr. Bul.* 981 (1921), pp. 68, figs. 25).—An account of the origin, characteristics, and botanical relationships of Sudan grass (*Andropogon sorghum sudanensis*), with remarks on Tunis grass (*A. sorghum virgatus*), Kamerun grass (*A. sorghum effusus*), tabucki and toura grasses (*A. sorghum verticilliflorus*), Hewison grass (*A. sorghum hewisoni*), chicken corn (*A. sorghum drummondii*), and sorghum-Johnson grass hybrids.

Based on the results of experiments throughout the country by this Department and the State experiment stations, the distribution and soil and climatic adaptations of Sudan grass are shown, and its uses as a catch crop and in rotations are indicated, together with cultural and field practices applicable to the production of hay and seed under different environmental conditions in the United States. Information is given on the culture of Sudan grass in legume mixtures, methods of utilizing the crop for hay, pasture, soiling, silage, and as a grain crop are outlined, and improvement procedure is stated in brief. Notes on diseases, insects, and weed pests are included.

Statistics on the distribution and production of sugar-cane varieties in Java in 1920 and 1921, P. VAN HARREVELD (*Arch. Suikerindus. Nederland. Indië*, 29 (1921), No. 45, pp. 1545-1566; also in *Meded. Proefsta. Java-Suikerindus., Landbouwk. Ser. No. 4* (1920-21), pp. 1-22).—Tabulated data, similar to those noted heretofore (*E. S. R.*, 45, p. 739), are presented showing the distribution and yield of sugar cane varieties in Java in 1920 and 1921. The leading varieties included EK 28, 247 B, DI 52, 100 POJ, and EK 2, occupying, respectively, 31.5, 26.5, 14, 10, and 6.5 per cent of the total area in 1920, and 39, 20.5, 15, 6.5, and 6.5 per cent of the total area in 1921.

Report of the departmental committee on wheat growing appointed by the Minister of Agriculture to inquire into the conditions of wheat grow-

ing in the Union of South Africa, A. HOLM, C. F. JURITZ, and H. S. DU TOIT (*Cape Town: Govt., 1919, pp. 140*).—Factors affecting wheat production in the several regions of the Union of South Africa are enumerated and discussed, together with statistics of the production of wheat and other cereals in the country. General problems considered include varieties, seed, labor, dry-farming methods, transportation, milling, marketing, and the effects of the war on the industry. In addition to summaries of evidence by farmers, millers, and implement dealers, the following papers are appended: *Wheat Soils of the Union: Physical and Chemical Analyses*, and *The Mixing of Fertilizers*, both by C. F. Juritz; *South African Insect Pests of Wheat*, by C. P. Lounsbury; and *Fungus Diseases of Wheat in South Africa*, by A. M. Bottomley.

Under normal conditions wheat is the most important fall or winter sown cereal in the Union, ranking next to corn in value, but climatic conditions and rust preclude its successful culture as a summer crop. In the regions of certain regular annual culture, the rising cost of production, diminishing soil fertility, and low yields indicate that no considerable increase in production can be expected and a decline is thought probable, unless better varieties, improved methods, and greater use of fertilizers stimulate increased returns. On the lower priced irrigated lands remote from railways wheat is likely to remain the most profitable cash crop. The cost of production is so much lower in the chief wheat-producing countries that the South African farmer could not grow wheat profitably except for the protection afforded by shipping cost, preferential railroad rates, and duties on imported wheat and flour. While wheat growing will never occupy the primary position in the agriculture of the Union of South Africa, it is maintained that if necessary sufficient wheat can be produced to satisfy the needs of its population.

The size of seed in relation to wheat yields, J. T. PRIDHAM (*Agr. Gaz. N. S. Wales, 32 (1921), No. 9, p. 616*).—The largest and smallest seeds from samples of several wheat varieties were sown in separate rows annually for more than 10 years. The largest grains were selected from the row sown from the largest seed, and the smallest grains from the produce of the row sown from the smallest seed. The use of small seed did not result in any apparent deterioration in the quality and vigor of the grain, but the acre yields were invariably low.

A new hardy variety of winter wheat, R. SUMMERBY (*Sci. Agr., 2 (1922), No. 5, pp. 168, 169, fig. 1*).—Kharkof 22 M. C. is described as a superior selection of Kharkof at Macdonald College, P. Q., sustaining an average of only 30 per cent of winterkilling and producing 44.5 bu. of grain per acre as compared with from 65 to 93.5 per cent of winterkilling and 40 to 43.3 bu. from other strains of Kharkof. Kharkof 22 M. C. is an awned variety with glabrous white glumes, medium sized, semihard to hard red kernels; the spike somewhat longer than that of the Kharkof variety, with a slight taper to the apex; long, narrow leaves; and good length and strength of straw. It has average tillering ability and the characteristic recumbent habit of autumn growth possessed by its parent.

In variety tests during seven years, Kharkof was winterkilled an average of only 35.1 per cent, while Dawson Golden Chaff, Turkey Red, and Red Velvet Chaff were winterkilled, 55.2, 52.4, and 39.5 per cent, respectively.

Speltoid variations in pure lines of wheat and in spelt, V. LATHOUWERS (*Variations Speltoides dans des Lignées Pures de Froment et dans une "Population" d'Epeautre. [Gembloux: Sta. Amélior. Plantes Cult.], 1920, pp. 6*).—The appearance of speltoids (E. S. R., 43, p. 534) in pure lines of Ralliance and Hybride Précoce II de Rimpau wheat and in a field of spelt is noted, and the segregation of progeny is recorded and discussed.

Weeds and weed seeds, G. H. CLARK (*Canada Dept. Agr. Seed Branch Bul. S-8 (1920), rev., pp. 68, figs. 174*).—Important Canadian weeds and their seeds are described and illustrated, and eradication methods outlined. The occurrence and effect of weed seeds in commercial and seed grain, in grasses and clovers, in screenings, in feeds, and in farm soils (E. S. R., 33, p. 138), are discussed.

HORTICULTURE.

Report of the horticultural section, C. P. HALLIGAN (*Michigan Sta. Rpt. 1920, pp. 278, 279*).—Without reporting data, observations are given on the progress and results of various experimental activities during the year ended June 30, 1920.

Dry lime sulphur when used at recommended strength was found to be unequal in value to the liquid form for summer spraying. Tests conducted to determine the comparative value of numerous arsenical compounds indicated that lead arsenate still remains the standard material for fruit spraying. Calcium arsenate, even with the addition of lime, caused serious foliage injury to apple and peach. Magnesium arsenate also proved unsatisfactory. It is recommended that 2 lbs. of lime be added to each 50 gal. of lead arsenate spray, except when used with Bordeaux mixture or lime sulphur. Lime-sulphur dust was equally efficient as lime-sulphur spray in controlling scab and codling moth.

[**Report of**] **the horticultural division** (*Canada Min. Agr. Rpt. 1921, pp. 14-16*).—Brief notes are given relative to the progress of various investigational activities at the several Canadian experimental stations for the year ended March 31, 1921. A list is included of fruits originated at Ottawa which are being propagated for sale.

Report on vegetable investigations being carried on by experiment stations and similar institutions, R. WELLINGTON (*Amer. Soc. Hort. Sci. Proc., 17 (1920), pp. 267-275*).—This is a summary of information obtained in response to letters of inquiry relative to vegetable investigations under way at many institutions in the United States, Canada, and Europe. The activities are grouped under 11 headings, of which rotation and fertilization and breeding contain much the greater number, indicating that these subjects are receiving particular attention at the present time.

Pentosan content in relation to hardiness of vegetable plants, J. T. ROSA, JR. (*Amer. Soc. Hort. Sci. Proc., 17 (1920), pp. 207-210*).—Data are presented relative to the changes occurring in the pentosan content of vegetable plants subjected to three different processes of hardening. In all three instances (reduction of water supply in the greenhouse, hardening in cold frames, and exposure of outdoor growing to the increasing cold of late fall), the pentosan content was found to increase as the plants gained in hardiness.

Pentosan content in relation to winter hardiness, H. D. HOOKER, JR. (*Amer. Soc. Hort. Sci. Proc., 17 (1920), pp. 204-207*).—In an attempt to discover possible correlation between pentosan content and hardiness, determinations were made of the pentosan content of the shoots of several fruit plants, including tender and hardy varieties of apples, currants, and raspberries.

The greater pentosan content of the hardier plants indicated close correlation between this factor and hardiness. In order to determine the relation between pentosan content and water-holding capacity, air-dried samples of the base and tips of long Ben Davis shoots were placed in desiccators over sulphuric acid. The basal portion with a pentosan content of 8.1 per cent lost less water and absorbed more from the atmosphere of the desiccator than the

tips with a pentosan content of 5.26 per cent. The theory is advanced that the pentosans in some manner function in the plant by holding water in colloidal mixture and that such water does not freeze under ordinary winter temperatures. The apparently greater water content of tender tips is presumed to be due to the presence of "free" water.

Has the orchard survey a place on the research program? R. D. ANTHONY (*Amer. Soc. Hort. Sci. Proc.*, 17 (1920), pp. 174-178).—An account is given of the methods employed in a survey of the important fruit districts of Pennsylvania, conducted in the summer of 1920. The author points out the difficulties encountered because of the broken nature of the country and of the wide variations existing in soil and climate. Data were obtained on approximately 20,000 acres of apple orchards. In addition, great benefit was believed to have accrued from the actual contact with the growers, the author concluding that field surveys are an excellent means of keeping teachers and investigators in close touch with practical conditions.

Responses of a young peach orchard to certain cover crops and fertilizer treatments, B. S. PICKETT (*Amer. Soc. Hort. Sci. Proc.*, 17 (1920), pp. 193-197).—Unexpected results were obtained in a study of fertilizers and cover crops in a peach orchard near Olney, Ill. The use of cowpeas as a cover crop decreased the yield of fruits and retarded the growth of the trees, proving of less value than clean tillage alone. This deleterious condition was fully corrected by the use of fertilizers containing potassium.

Cultivation of the Smyrna fig, G. P. RIXFORD (*Hacienda*, 16 (1921), No. 14, pp. 418-427, figs. 9).—An abundantly illustrated article relating to Smyrna fig culture in America, with reference to climate and soil requirements, varieties, dependence upon the blastophaga insect for pollination, etc.

Report of insecticide and fungicide inspection, A. J. PATTEN (*Michigan Sta. Rpt. 1920*, pp. 269-275).—Analyses are reported of 73 samples collected during the year 1920.

FORESTRY.

The valuation of American timberlands, K. W. WOODWARD (*New York: John Wiley & Sons, Inc.; London: Chapman & Hall, Ltd.*, 1921, pp. VII+246, pl. 1, figs. 14).—A compilation relative to the principal forest types of the United States and outlying possessions, excepting Hawaii and the Canal Zone, together with general information relative to methods of estimating value of timber, costs of logging, determination of stumpage, prices, etc. The individual types are discussed with reference to distribution, size and nature of stand; accessibility; value of timber, stumpage, and land; and the possibility of obtaining clear titles.

Forest mensuration: Tables for the measuring of logs, trees, and growth of stands, H. O. COOK and R. T. FISHER (*Boston: Mass. Dept. Conserv.*, 1921, pp. 69, pl. 1, fig. 3).—A small handbook presenting mensural data concerning the more important forest tree species of Massachusetts.

Recent investigations on the germination and culture of forest seeds, W. E. HILEY (*Quart. Jour. Forestry*, 15 (1921), No. 3, pp. 160-168).—An article, based upon the results of various European investigations, pointing out variations which exist between seeds of different forest species in respect to period of dormancy, rate and manner of germination, and response to different nursery treatments.

Growth tests of forest trees (*Kansas Sta. Rpt. 1920*, pp. 20, 21).—Based on measurements made in December, 1919, the average height and diameter are given for eight species of forest trees planted at Manhattan, Kans., in 1896, in

cooperation with the U. S. Department of Agriculture Forest Service. The locust, *Gleditschia triacanthos*, made the greatest height and the box elder, *Acer negundo*, the largest diameter growth.

Fiber studies of Philippine dipterocarps, L. J. REYES (*Jour. Forestry*, 19 (1921), No. 2, pp. 97-104).—In this investigation of the length and width of the fibers of 33 species of Dipterocarpus growing in the Philippine Islands, the author found that in general there was little variation between species. The wood of single species, however, was observed to vary remarkably in color and density according to the place of origin. As a rule the longest fibers were found associated with soft woods. However, in certain species of similar density greater fiber length was found correlated with larger pores. The species, *Shorea eximia*, *Pentacone* spp., and *Parashorea malaanonan*, are deemed of value as sources of pulp wood on account of the greater length of their fibers.

Boxwoods of commerce, S. J. RECORD (*Bul. Torrey Bot. Club*, 48 (1921), No. 11, pp. 297-306, fig. 1).—This paper, a contribution from the Yale School of Forestry, discusses the various commercial boxwoods with reference to source, properties, uses, and substitutes. *Buxus sempervirens*, a species found throughout central and southern Europe, northern Africa, and parts of Asia, supplied for many years the only commercial boxwood, but due to depletion this has been largely supplanted by species obtained from various parts of the world, chiefly Africa and tropical America. In studying the American boxwoods, which now furnish the greater part of the commercial product, the author found that at least three species are utilized, namely, *Casearia praecox*, *Aspidosperma vargasii*, and *Phyllnostylon brasiliensis*. *Cornus florida*, our common flowering dogwood, has also served as a substitute. Technical descriptive keys are given for the more important species.

Cedrela toona, K. A. CARLSON (*Union So. Africa, Dept. Agr. Jour.*, 3 (1921), No. 3, pp. 231-245, figs. 4).—Data are presented relative to *C. toona*, a forest species native to semitropical India, but which has shown considerable merit in South Africa on account of rapid growth, easy acclimatization, and valuable qualities of the wood. Data are presented relative to rate of growth, propagation, and behavior under various soil and climatic conditions.

Replacement of the chestnut, J. S. ILLICK (*Jour. Forestry*, 19 (1921), No. 2, pp. 105-114).—In recording species which are replacing the chestnut in Pennsylvania following the devastation of blight, it was observed that on dry hill-sides, chestnut oak, pitch pine, black locust, black birch, and black oak were in close association with the chestnut, and that on foothill sites under moister conditions red and white oak, white ash, tulip tree, and white pine usually occurred. The author, pointing out that of these 10 species, white ash, tulip, and red oak are deemed of special value, presents data to illustrate the value of some of the other seven species. Growth records are presented for chestnut oak, pitch pine, and black locust, and remarks are included relative to Table Mountain and Jersey pine and other species which are considered of some value for certain localities. It is believed that nature will largely supplant the chestnut with satisfactory species, but where planting is resorted to pitch, jack, and Scotch pine are held to be particularly desirable species. White pine may be used in moist situations at lower elevations.

Factors controlling the distribution of Douglas fir in semiarid regions of the Northwest, F. W. GAIL (*Ecology*, 2 (1921), No. 4, pp. 281-291, figs. 3).—A quantitative study, conducted in Latah County, Idaho, on several physical factors which are believed to be largely responsible for confining Douglas fir to the northerly slopes. In order to study the effect of contrasting conditions two stations were established, one on a typical southerly exposure and the

other on a northerly slope which was covered for the most part with a dense stand of Douglas fir.

Weekly records taken during four summer months of 1915 and 1916 are presented, partly in graphical and tabular form, and show sharp variations between the conditions existing on the two slopes. It was found that during the height of the summer season evaporation was much less on the northerly slope, the relative humidity was higher, the moisture content of the soil continued at an unfavorable point for a much less extended period, the temperature of the soil and air fluctuated much less and did not reach the extremes, the velocity of the wind was remarkably less, and in every way conditions were more favorable for successful plant growth than on the southerly exposure. The author believes that the combination of unfavorable factors generally prevailing on southern slopes presents a situation too rigorous for the more mesophytic trees, such as Douglas fir. Very little germination of seed takes place on the southern exposure, and of the few trees that grow less than one per cent can endure the drought of the first season.

Lignum-vitae, S. J. RECORD (*Yale Univ. School Forestry Bul.* 6 (1921), pp. 48, pls. 7, figs. 3).—The author in continuing his study of lignum-vitae (E. S. R., 41, p. 244) presents in this paper a careful study of various producing species, their source, uses, and relative importance. The family Zygophyllaceae, of which only three genera, Guaiacum, Porlieria, and Bulnesia, include species of tree size, supplies the true lignum-vitae of commerce. All these three genera are confined to the tropical and subtropical regions of the Western Hemisphere. Porlieria is not considered of commercial importance, although supplying a limited amount of wood. Bulnesia through one species, *B. arborea*, supplies timber in marketable quantity but of inferior quality. Guaiacum, of which six species have been technically described, furnishes the greater part of the true lignum-vitae of commerce, a wood which on account of its density, hardness, extreme toughness, resistance to wear, and high resin content is of great commercial value. When utilized as bearings for lining propeller shafts of steamships it has been found to outlast steel or bronze. Comprehensive data are given relative to the several species of Guaiacum, their distribution, and extent of stands. Information is also given relative to various woods grown in many parts of the world which are often substituted for the true lignum-vitae.

Relations between soil type and root form of western yellow pine seedlings, F. W. HAASIS (*Ecology*, 2 (1921), No. 4, pp. 292-303, figs. 3).—A record of observations made upon the root development of 268 western yellow pine seedlings growing in five distinct soil types near Flagstaff, Ariz.

The data obtained indicate that the character of the soil is an important factor in determining the length and form of the root and the general welfare of the tree. Of the five soil types studied, designated as loamy rock, stony clayey, gravelly, cindery, and clayey, the latter two were found, because of an apparent deficiency in moisture, to be wholly unadapted to the growing of young pines. The root development in these two unfavorable types was found to be of extreme character in that the longest roots and fewest laterals occurred in the clay and the greatest development of branch roots in the cindery type.

High temperatures and eucalyptus, E. N. MUNNS (*Jour. Forestry*, 19 (1921), No. 1, pp. 25-33).—This is a record of the effect of the unusually high temperatures which prevailed in June, 1917, in southern California upon trees of the genus Eucalyptus. Variation in the amount of moisture in the soil was found to be an important factor in determining the amount of injury, which ranged from zero to total killing. Trees growing in sandy soils apparently suffered much more severely than those growing in more retentive types, particularly

loamy soils. Observations upon 10 species of eucalypts indicated that two, *E. rostrata* and *E. tereticornis*, appeared to withstand the unusual conditions to the best advantage, and are therefore recommended for planting in regions exposed to extraordinarily high temperatures and evaporation.

Snowshoe rabbits and conifers in the Wasatch Mountains of Utah, F. S. BAKER, C. F. KORSTIAN, and N. J. FETHEROLF (*Ecology*, 2 (1921), No. 4, pp. 304-310, fig. 1).—Emphasis is placed upon the extent and serious nature of rabbit injury to young conifers in the Wasatch Mountains. The damage was found to be most severe during the winter season when the deep snow afforded the rabbits an opportunity of reaching the tops of the small trees. Tabulated comparisons of the growth of normal and injured trees of three species, *Pseudotsuga taxifolia*, *Abies concolor*, and *A. lasiocarpa*, show the very serious inhibiting effect of rabbit injury. Poisoning is considered to be the most feasible method of control on large areas, and formulas are given for the preparation of poison baits.

DISEASES OF PLANTS.

Plant protection, M. SCHWARTZ (*Naturw. Wehnschr.*, 36 (1921), No. 37, pp. 532-535).—Argument is offered for the organization of plant protection as a separate division of science enlisting the services and cooperation of other appropriate sciences. An account is given of the organization of agriculture in America and elsewhere.

Practical plant protection, L. HECKE (*Arb. Deut. Landw. Gesell. Österr.*, No. 4 (1920), pp. 121-135).—Discussion is given, from a practical standpoint, on protection against prevalent diseases, chiefly cryptogamic, of plants having economic importance.

Report of the committee on botany and plant diseases, F. C. STEWART (*N. Y. State Hort. Soc. Proc.*, 2 (1920), pp. 38-44).—This report deals with apple scald, scab, crown gall, canker, and rust; also with peach fruit rot and winter injury. Discussion is presented also regarding the practice of picking strawberries while wet with dew, the barberry eradication campaign, calculating the value of commercial sprays, and currant sunburn.

Report of the mycologist, W. F. BEWLEY (*Expt. and Research Sta. Cheshunt, Herts., Ann. Rpt.*, 5 (1919), pp. 21-38).—The investigations here reported as begun in May, 1919, have been directed mainly toward tomato stripe (*Bacillus lathyri*) and damping-off (*Phytophthora* spp. and *Rhizoctonia solani*), also to such other tomato diseases as foot rot (*Phytophthora* sp.), buckeye rot of the lower trusses (*P. terrestria*) equivalent to *P. parasitica*, destruction of leaf bases and stem (*Botrytis* sp.), leaf mottling (mosaic?), sleepy disease (*Verticillium* sp.), fruit diseases (*Macrosporium solani*, *Verticillium* sp.), bacterial rot, *Penicillium* sp., blossom-end rot (physiological), and destruction of green fruit (*Rhizopus nigricans*); such cucumber diseases as leaf spot (*Colletotrichum oligochaetum*) and wilt (*Verticillium* sp. and *Fusarium* sp.); vine fruit rot (*R. nigricans*); and chrysanthemum lower leaf bronzing (*Aphelenchus* sp.).

Stripe disease of tomato was investigated (first severally, then unitedly) by W. F. Bewley and S. G. Paine, and the results are detailed. Control methods include sterilization of the soil by heat and of the seed by formalin, selection of resistant varieties, sterilization of tools, removal of diseased stems, and supplying sufficient potash without excess of nitrogen.

A study of damping-off is also detailed. It is concluded that damping-off of tomato seedlings is a communicable disease due to several pathogenic organisms, particularly *Phytophthora* spp. Seedling infection comes primarily from the

soil and from water, and may be carried over in seed boxes and pots. Soil sterilization by heat or formaldehyde with use of sterile water gives complete protection.

[Plant diseases in Germany] (*Mitt. Deut. Landw. Gesell.*, 35 (1920), No. 37, pp. 500, 501).—Notes are given regarding the outbreak, distribution, and effects of black rust and other cereal diseases, also regarding American gooseberry mildew.

Report of phytopathological service for 1919, N. VAN POETEREN (*Verslag. en Meded. Phytopath. Dienst Wageningen*, No. 12 (1920), pp. 48).—This report contains information secured regarding phases of injury to economic plants, principally by fungi but also by nematodes and parasitic higher plants.

Mycology, L. D. SWAMIKANNU (*Madras Dept. Agr. Rpt. 1919-20*, pp. 15, 16).—A condensed account is given of work done during the year by W. McRae, imperial mycologist.

Paddy blast (*Piricularia oryzae*) has been kept under observation in districts named. Similar diseases have been found on ragi (*Eleusine coracana*), tenai, and wheat. Blasts on these plants and on ginger grass, though they will not cross-infect readily, were found to infect both wheat and barley. *Piricularia* from tenai will grow on bruised portions of ragi leaves. Spraying was successful against grape *Oidium*. Bleeding disease of coconut was successfully treated, as were also scrub of orange and lime trees, coffee black rot, and tea brown blight.

Cryptogamic parasites, J. R. BAEZ, (*Min. Agr. [Argentina], Dir. Gen. Enseñanza Agr. [Pub.] No. 87* (1920), pp. 40).—The author lists, in connection with diagnosis and recommended treatment in some cases, 7 bacteria and 88 fungi as parasitic on plants in the Province of Entre Rios, Argentina.

The present status of dusting, H. H. WHETZEL (*N. Y. State Hort. Soc. Proc.*, 2 (1920), pp. 45-76).—Data are presented with discussion, as assembled and averaged or summarized, from reports on the experimental work of dusting for fruit diseases and pests, during the same year, in New York, Michigan, Illinois, Georgia, West Virginia, Virginia, and Nova Scotia. Discussion is also given regarding the relative effectiveness of fungicides and such factors as expense of time, labor, and methods.

Cereal and forage crop diseases (*Kansas Sta. Rpt. 1920*, pp. 21, 22).—Brief outlines are given of investigations in progress at the station.

In connection with work on the corn smut and root-rot diseases, it is stated that differences in resistance were noticed in corn plants produced from seed from selected ears of commercial white corn. A survey of cereal and forage crop diseases indicated that the presence of black chaff has caused considerable injury in 1919. It is reported as being closely related to the quantity of rainfall and degree of humidity occurring between the time the heads of wheat appear and harvest.

Cereal disease investigations, G. H. COONS (*Michigan Sta. Rpt. 1920*, p. 266).—The author states that field tests of various methods of treatment for the prevention of wheat smut have shown that complete control of the stinking smut may be obtained by immersing the grain in water and skimming off the smut balls. The so-called sprinkling method, while reducing the amount of smut, does not completely eradicate it, nor does the dry method, although with a fairly clean sample this treatment reduces smut almost to the vanishing point.

Flag smut and its control, C. O. HAMBLIN (*Agr. Gaz. N. S. Wales*, 32 (1921), No. 1, p. 23).—It is claimed that stock fed on diseased hay may spread the spores of flag smut.

The relation of native grasses to *Puccinia graminis* in the region of Iowa, western Illinois, Wisconsin, southern Minnesota, and eastern South

Dakota, L. H. PAMMEL (*Iowa Acad. Sci. Proc.*, 26 (1919), pp. 163-192, pl. 1, figs. 10).—A detailed study of wheat stem rust (*P. graminis*) in relation to wheat and other plants leads to the view that while the barberry is an important factor in wheat rust production, it is probably not the only one. It is thought possible that under certain conditions the mycelium may be perennial, that uredospores may be viable in the spring, or that rust may move northward as the season advances. Outbreaks in the North appear to be due to the aecial stage on the barberry, the removal of which is, therefore, very desirable as leading to an increase in the production of wheat, oats, and barley. It is said that wherever barberry was found there was much rust on grain and such wild grasses as squirrel tail, reedtop, quack grass, Macoun wild rye, western wheat grass, and in some cases timothy.

The barberry in Iowa and adjacent States, L. H. PAMMEL (*Iowa Acad. Sci. Proc.*, 26 (1919), pp. 193-237, figs. 31).—Former and recent history of the barberry is reviewed. Discussion is given, with summary, of 22 localities in which wild, escaped barberries of the common variety (*Berberis vulgaris*) injurious to wheat (causing leaf rust) were found. A bibliography is given of articles on cereal rust in Iowa.

[Preventive] treatment of cereal seed, RIEHM (*Mitt. Deut. Landw. Gesell.*, 35 (1920), No. 44, pp. 596, 597).—Heavy losses due to cereal disease are discussed in connection with existing neglect of remedial measures.

Treatment of winter grain seed, L. HILTNER (*Mitt. Deut. Landw. Gesell.*, 35 (1920), No. 36, pp. 486, 487).—Brief details are given regarding the efficiency of treatments for diseases on seeds of cereals, including wheat and rye.

The biology of *Bacillus carotovorus*, M. EISLER and L. PORTHEIM (*Centbl. Bakt. [etc.]*, 2. Abt., 53 (1921), No. 1-3, pp. 7-33; *abs. in Abs. Bact.*, 5 (1921), No. 5, p. 176).—Distinct evidences of specialization as regards both appearance and capability to cause infection (producing a soft root rot) in *Daucus carota* were obtained from strains of *B. carotovorus* developed under different conditions indicated.

Mammoth clover rust, W. H. DAVIS (*Iowa Acad. Sci. Proc.*, 26 (1919), pp. 249-258, figs. 8).—Investigations bearing on the possible identity of the rust on mammoth with that on red clover are said to show that the causal organism is probably *Uromyces trifolii*, and also that it can live on either mammoth or red clover, but can not be transferred to alsike or to white clover. Morphological differences between this rust on mammoth clover and that on red clover appear in the spore size and in the thickness of the peridial cells.

A fruit spot of cucumber (*Phytophthora infestans*), A. PACHANO (*Bol. Agr. Quinta Normal [Ambato, Ecuador]*, 1 (1920), No. 8-9, pp. 201-206, figs. 2).—Attention is called to the fact that *Cucumis sativus* is attacked by *P. infestans*, causing a characteristic form of injury. Humidity is a favoring factor.

The mushroom root rot, A. FRANK (*Washington Sta., West. Wash. Sta. Bimo. Bul.*, 9 (1922), No. 6, pp. 83, 84, fig. 1).—A popular description is given of the mushroom root rot due to *Armillaria mellea*, which is said to be prevalent in western Washington, where it attacks many varieties of berry plants and fruit trees.

Black scab in potatoes (Ireland Dept. Agr. and Tech. Instr. Jour., 20 (1920), No. 2, pp. 238-241, figs. 3).—Black scab, occurring during recent years in many parts of Great Britain and in a few isolated districts in Ireland, is considered one of the most serious of the potato diseases in this region. The disease lies dormant in the soil for many years, no eradication treatment having yet proved practically effective. The planting of resistant varieties is the condition abso-

lutely necessary to the production of sound potatoes on land infected with black scab. Eight varieties are listed as immune.

Common scab of potatoes (*Actinomyces scabies*), W. A. MILLARD (*Univ. Leeds and Yorkshire Council Agr. Ed. [Pamphlet] 118 (1921), pp. 22, pls. 15*).—Potato common scab is said to cause important losses in certain areas indicated. The present report gives a description of the disease, a résumé of previous knowledge as to causation and remedial measures, and a detailed account of some experimental work done by the author during 1914 to 1921, inclusive. Studies here described isolated several strains of the causal fungus, but they are all for the present permitted to remain with *A. scabies*. Scab was not produced by a mechanical injury from soil particles. The organisms are thought to be abundant in the soil, but to cause chiefly decomposition of organic matter until their natural food supply (chiefly herbaceous plant residues, as leaves) becomes exhausted, when they attack the tubers, causing scab. Prevention may, therefore, be accomplished by furnishing plant material in sufficient quantity, as by forking in grass cuttings or half-decayed leaves before planting potatoes.

Control of potato leaf roll, NEGER (*Sächs. Landw. Ztschr.*, 68 (1920), No. 27, pp. 271, 272).—Experimentation is briefly indicated in which potato tubers from a stock subject to leaf roll in severe form were placed to sprout in a hothouse about February 1, the plantlets which appeared being removed to a growing house the daily temperatures in which ranged from near freezing at night to as high as 30 or 40° C. (86 to 104° F.) under direct sunlight.

Before the end of March leaf roll appeared in severe form, associated with chlorosis. Some of these plants were then permitted to remain in the growing house, while others were kept during 7 p. m. to 8 a. m. in a room maintained at 20° C., and during the rest of the day in the growing house near the others. This was kept up from March 23 to April 12.

It was found that while the group subjected to low night temperatures showed more and more tendency to decline with chlorosis and intensive starch accumulation in the leaves, the group which was protected from low night temperatures showed but little leaf roll, while starch was removed in a normal manner from the leaves.

The results are considered to indicate that cold nights tend to increase, while even temperatures tend to decrease, leaf roll in potatoes.

Potato wart disease [in the Netherlands] (*Verlag. en Meded. Phytopath. Dienst Wageningen*, No. 16 (1920), pp. 19, pls. 5).—Potato wart disease (*Chrysophlyctis endobiotica*) is said to have been discovered in the Netherlands in 1915 and to have appeared subsequently at points named. Attempts at control are indicated.

Diseases of sugar beets, J. A. BROCK (*Facts About Sugar*, 12 (1921), Nos. 24, pp. 470, 471; 26, pp. 511, 517).—Data arranged from his own field and laboratory records and other sources are presented by the author in regard to water-core spots, soft rot (*Bacterium teutlium*), tuberculosis (*Pseudomonas beticola*), scab (*Actinomyces chromogenus*), root tumor (*Urophlyctis leproides*), damping-off and root rot caused by *Pythium debaryanum* and possibly other organisms, root rot (*Corticium vagum*), crown gall (*Pseudomonas tumefaciens*), white rust (*Cryptospor bliti*), downy mildew (*Peronospora schachtii*), rust (*Uromyces betae*), leaf spot and heart rot (*Phoma betae*), and leaf spot (*Cercospora beticola*).

Sugar-cane gummosis in Porto Rico, J. MATZ (*Rev. Agr. Puerto Rico*, 6 (1921), No. 4, pp. 33-39, figs. 2).—Information is given regarding sugar-cane gummosis (*Bacterium vascularum*), observed for the first time in Porto Rico

early in 1920, also regarding the later-appearing vascular complication due to the presence of a *Plasmodiophora*.

Tomato fungus diseases [and insect enemies], R. RAMÍREZ ([*Mex.*] *Sec. Agr. y Fomento, Dir. Agr. Bol.* 107, n. ser. (1920), pp. 62-72, figs. 11).—This portion of the present report deals descriptively with tomato diseases related to *Bacillus caulivorus*, *B. solanacearum*, *B. oleraceae*, *Phytophthora infestans*, *Erysiphe communis*, *Septoria lycopersici*, *Fusarium lycopersici*, *F. erubescens*, *Colletotrichum* (*Gloeosporium*) *phomoides* and *C. lycopersici*, *Phyllosticta solanicola* or *Ascochyta lycopersici*, *Cladosporium fulvum*, *Cercospora physalidis*, *C. diffusa*, *Glomerella rufomaculans*, *Alternaria* (*Macrosporium*) *solani*, *Rhizoctonia solani*, and *Aspergillus* sp.; also with insect injuries and remedial measures.

Tomato diseases, C. C. BRITTLEBANK (*Jour. Dept. Agr. Victoria*, 18 (1920), No. 7, pp. 413-416; also in *Trop. Agr. [Ceylon]*, 55 (1920), No. 6, pp. 381-385).—Tomato diseases briefly discussed as present in Victoria include bacterial wilt (*Bacillus solanacearum*), blight (*Phytophthora infestans*), wilt (*Fusarium lycopersici*), target spot (*Alternaria solani*), root rot (*Rhizoctonia solani*), and damping-off (*Pythium debaryanum*).

Spotted wilt of tomatoes, C. O. HAMBLIN (*Agr. Gaz. N. S. Wales*, 32 (1921), No. 1, p. 50).—Study of tomatoes affected with spotted wilt has shown no trace of fungi, and no bacteria causing the disease under experimental conditions, though the indications are to the effect that the disease is infectious. Apparently the trouble is not transmitted by means of the seed.

Silver leaf of fruit trees, T. A. C. SCHOEVEERS, H. A. A. VAN DER LEK, and N. VAN POETEREN (*Verslag. en Meded. Phytopath. Dienst Wageningen*, No. 10 (1920), pp. 12, pls. 2, fig. 1).—The authors, severally, deal with the fruit tree silver leaf disease, the fruiting bodies of *Stereum purpureum*, and control measures.

Fire blight: Bacteriological history in New Zealand, R. WATERS (*New Zeal. Jour. Agr.*, 22 (1921), No. 3, pp. 143-145).—In a brief account of the investigation of fire blight which followed its suspected appearance in the Auckland Province late in 1919, it is stated that an organism closely resembling *Bacillus amylovorus* was obtained, which on inoculation produced typical fire-blight symptoms. The New Zealand fire-blight bacillus, as it has been called, was subjected to comparative study and to tests in connection with other possible hosts. Medlar, not previously recorded as a host for fire blight, develops an enormous number of bacilli, which appear to be of the most resistant strain yet isolated of the New Zealand fire-blight organism.

Investigations of lime treatment as a blight remedy (*Yakima County, Wash., Dist. Hort. Insp. Ann. Rpts.*, 1918-19, pp. 45, 46).—Investigation was made of a claim that fire blight of apple could be started to dry up in from three to five days by raking lime into the surface of the soil around the tree. The results showed practically no effect from such treatment. Apparently the main limiting factor in the spread of this disease is the vigor and succulence of the tree growth in the presence of the infective matter.

The control of cedar rust on apples, F. C. STEWART (*N. Y. State Hort. Soc. Proc.*, 2 (1920), pp. 205-214).—An account of cedar rust, followed by discussion, concludes that in eastern New York orchard practice should, as a main measure, attempt to get rid of all red cedar within one mile of orchards and, if necessary, keep apple foliage well covered with lime sulphur during growth. Resistant varieties should be planted in renewing orchards. The ordinary local apple rust is caused by *Gymnosporangium juniperi-virginianae*, though part of the rust in this region is due to *G. globosum*.

Drought spot and related physiological diseases, D. F. FISHER and C. BROOKS (*Agr. Jour. [Brit. Columbia]*, 5 (1920), No. 10, pp. 290, 291, 293, 295, figs. 6).—Since their first experience (1913) with drought spot (*E. S. R.*, 33, p. 348), featured by its experimental production through selection of soil and location and control of irrigation, the authors have encountered this disease every year, always associated with soils inadequately irrigated and sensitive to interruption of the water supply. Differences in the reaction of varieties to such conditions are indicated. Their studies on this trouble and on others closely related thereto have been noted (*E. S. R.*, 35, p. 456; 36, p. 50; 38, p. 753; 39, p. 241). It is concluded that the spotting is due not to any forcing incident upon a sudden resumption of growth after water again becomes available, but rather to the local withdrawal of water to supply a deficiency elsewhere and the consequent death of the cells from which the water is extracted. As many as three different drought reactions have been observed upon the same fruit in one season, each due to a separate drought period. While the disease may appear at almost any stage in the development of the apple, it is most common after the fruit is one-third grown.

The disease, or group of diseases, passing under the name of cork may be similar to drought spot as regards cause, though many of its gross characteristics are distinctly different from those of drought spot. Troubles identical with cork or closely related thereto are widely distributed, and have been observed all over the Pacific Northwest, in the Champlain region of New York, and in the Virginias, supposedly also in Australia.

Losses due to cork are usually local, but sometimes severe. Considerable loss was annually caused in the Hood River Valley before the introduction of systematic irrigation, since which time it has been practically eliminated. Local occurrences of cork in the Wenatchee and other sections of the country have been closely studied. No relation of insects, fungi, or bacteria to the disease has been found. Its occurrence, however, is always associated with certain peculiar soil types, very shallow or very open and markedly deficient in humus, retaining an inadequate amount of soil moisture. Intermittent water supply implies a de-ranked and abnormal nutrition, and this factor may likewise be concerned in some manner.

It is considered questionable whether apple growing should be encouraged on such uncongenial soil types as those which give rise to cork and blister. The only remedies suggested are such as will build up a soil-moisture reservoir, like the incorporation of large quantities of humus, preferably barnyard manure. This should be accompanied by frequent and well-controlled irrigation until the soil is practically made over.

Another recognized type of drought reaction results in what is called punk apples. The flesh is dry, mealy, and brown or streaked with brown, somewhat similar to that of an apple in the condition of physiological breakdown at the end of its life in storage. The apples also have a very pronounced rubbery feel when compressed in the hand.

A trouble known in Virginia as York spot, because of its prevalence on York Imperial, also appears to be associated with drought conditions and intense heat or sunlight.

Drought spot on prunes and plums is thought to come about in the same manner as on apples; that is, by the withdrawal of water from the fruit after the foliage begins to wilt. The resulting death of pulp cells along the sap channels, from which excessive water loss has occurred, gives rise to the areas of hard brown tissue that persist as the fruit ripens and gives to it the characteristic bitter taste, which has caused this trouble, supposedly without suffi-

cient reason, to be classified as a form of bitter pit. A copious exudation of gum also occurs from the injured area, bursting the skin and hardening into a crystalline deposit.

The resultant of all these drought reactions is in general the same; that is, a collection of dead cells in the pulp or skin of the fruit, resembling cases of cells killed by other agencies, as in bitter pit and stigmonose. The dead cells appear very much alike, regardless of the killing agency, being brown and spongy or corky, and usually more or less bitter. Generally all contain starch grains. These facts readily lead to confusion of the several diseases and to incorrect treatments.

Powdery mildew on apple [in South Africa] (*So. African Fruit Grower and Smallhold.*, 6 (1919), No. 12, pp. 343, 345, fig. 1).—In an article by H. B. Terry, attention is drawn to notes by E. M. Doidge relating to apple varieties affected by powdery mildew, symptoms of the disease, and control measures.

Fungus and other diseases of stone fruits, G. P. DARNELL-SMITH (*N. S. Wales Dept. Agr., Farmers' Bul.* 133 (1920), pp. 23, figs. 15).—This account of leaf curl (*Eroascus deformans*), brown rot (*Monilia fructigena*), rust (*Puccinia prunispinosae*), and freckle (*Cladosporium carpophilum*) includes local features and treatments.

Diseases of stone fruit trees, E. M. DOIDGE (*So. African Fruit Grower and Smallhold.*, 6 (1919), Nos. 8, p. 211; 10, pp. 271, 273, fig. 1; 11, p. 305).—These three sections, respectively, deal very briefly, as regards local aspects and control, with peach leaf curl (*Taphrina deformans*) and other *Taphrina* diseases of stone fruit trees; peach, apricot, and nectarine fruit freckle or scab (*Cladosporium carpophilum*), also injury from the same organism to twigs and leaves; and fruit brown rot or mold (*Sclerotinia fructigena*), attacking practically all of the stone fruits.

Downy mildew of the vine, C. O. HAMBLIN (*Agr. Gaz. N. S. Wales*, 32 (1921), No. 1, pp. 49, 50, pls. 2).—Grape downy mildew was observed at Albury and Glenfield in January, 1918, and has since caused damage at various points, ranging from slight to severe. Bordeaux mixture at 6:4:40 has proved very efficacious. Some commercial brands of Bordeaux paste and Bordeaux powder have also given effective control. Applications must be made at intervals of not over 10 to 14 days up to the time of ripening.

Bunchy top in bananas, G. P. DARNELL-SMITH (*Trop. Agr. [Ceylon]*, 55 (1920), No. 6, pp. 380, 381).—Attention is called to some internal signs of banana bunchy top, and recommendations are made regarding measures looking to the control of the disease.

Tear stain of citrus fruits, J. R. WINSTON (*Citrus Indus.*, 2 (1921), No. 8, pp. 7-9).—Florida citrus fruits are subject to withertip (*Colletotrichum gloeosporioides*?) and to melanose tear streak (*Phomopsis citri*). Observations and experiments during four years show that one application of weak lime sulphur solution, made at a time suitable for control of rust mite, was effective for control of withertip tear stain, though Bordeaux mixture did not reduce the blemish. The melanose organism is not discussed in this connection.

Relation between cacao pod rot and coconut bud rot, S. F. ASHBY (*Agr. News [Barbados]*, 20 (1921), No. 507, p. 318).—Limited studies, involving cross-inoculation and examination of pure cultures grown on the same media in case of the fungi (*Phytophthora* spp.) causing, respectively, cacao pod rot and coconut bud rot, indicate, though not yet conclusively, that the organisms are not identical.

Notes on two diseases of the coconut palm in Jamaica caused by fungi of the genus *Phytophthora*, S. F. ASHBY (*West Indian Bul.*, 18 (1920), No.

1-2, pp. 61-73).—This account deals with macroscopic and microscopic, inoculation, culture, distribution, and remedial studies of coconut bud rot (*Phytophthora palmivora*) and of leaf stalk rot (*P. parasitica*).

The red ring disease of coconut palms, W. NOWELL (*West Indian Bul.*, 18 (1920), No. 1-2, pp. 73-76).—Fuller information is herein furnished than was given in the author's previous account (*E. S. R.*, 45, p. 653), the studies now noted including inoculations in the stem, petioles, and axils. Trees inoculated with material from the red ring in a tree infested with *Aphelenchus cocophilus* usually developed disease symptoms and showed the presence of the nematode.

The rapidity of the spread of the infection shown in certain cases is admitted to render untenable the hypothesis formerly offered by the author that infection may occur at an early age of the tree without showing until the tree matures.

The coffee leaf spot in Porto Rico, T. B. McCLELLAND (*Porto Rico Sta. Bul.* 28 (1921), pp. 12, pls. 4).—A description is given of the coffee leaf spot due to *Stilbella flavida*, with suggestions for its control. On the basis of experiments carried on by the station covering a number of years, the author recommends the weeding of coffee areas, cutting the trees to stumps about 6 in. from the ground, and allowing one or two suckers to sprout from the stumps. The completeness of control will depend very largely on keeping the coffee areas free from weeds which may harbor the fungus, and preventing the reintroduction of the fungus in the cleared areas.

A ripe rot of papayas, P. A. VAN DER BIJL (*So. African Fruit Grower and Smallhold.*, 6 (1919), No. 7, p. 177, figs. 4).—A papaya rot, said to be common along the coast of Africa, has been found associated with spore forms belonging to *Gloeosporium papayae*, *Phoma* sp., and *Mycosphaerella* sp. Colletotrichum is said to be common on dead leafstalks, but not to infect the fruit.

The vanilla industry [and diseases], P. R. DUPONT (*Seychelles Agr. and Crown Lands Ann. Rpt.*, 1920, p. 3).—It is stated that vanilla is attacked in Seychelles as elsewhere by a large number of diseases, of which little is known. Steps have been taken or planned to study these diseases, and to counteract their effects by manuring and by the introduction of resistant strains.

Leaf spot of orchids, W. B. BRIERLEY (*Gard. Chron.*, 3. ser., 65 (1919), No. 1676, pp. 61, 62, fig. 1; *abs. in Rothamsted Expt. Sta., Harpenden, Rpt. 1918-1920*, p. 52).—Studies by the author, as by others named, led to the conclusion that orchid spot is not a single and specific disease, but a congeries of diseases little understood and requiring detailed and intensive investigation. Types of orchid-spot disease are indicated with discussion, and very brief notes are given on treatment.

Forest pathology, J. H. FAULL (*Ontario Min. Lands and Forests Rpt. 1920*, pp. 224-235, figs. 10).—An account is given of investigations made during the summer of 1920, chiefly on diseases of timber trees in the Temagami Forest Reserve, but partly also on hardwood diseases in Algonquin Park, the effect of sulphur fumes in the Sudbury District, and the conditions of mine timber decay and preservation in the Cobalt area.

The white pine needle blight, noted since 1905 and studied since 1918, is said to be physiological in its nature. Winter browning of coniferous foliage is due to excessive loss of moisture during warm, bright winter weather while the ground is still frozen. Notes briefly discussing diseases of pulp wood trees refer to red branch and twig blight of balsam and a canker of aspen. A preliminary note is given on heart rots of coniferous trees, which are said to cause immense loss in connection with windfalls, partly due to increased exposure.

Black stripe and moldy rot [of *Hevea brasiliensis* in Malay] (*Trop. Agr. [Ceylon]*, 55 (1920), No. 6, pp. 373-379).—This is a condensation of the bulletin by Sharpless and others (*E. S. R.*, 44, p. 750).

Certain host plants of *Fomes lignosus* and *Ustilina zonata*, F. W. SOUTH (*Agr. Bul. Fed. Malay States*, 8 (1920), No. 4, pp. 242, 243).—On a rubber estate in Selangor rubber trees were severely attacked in May 1920, by *F. lignosus*. This appeared to be greatly aided by the presence of the infection in old bamboo stumps, and probably also by soil conditions due to the presence of sweet potato vines thickly covering the ground.

In September, 1920, stumps of "pinang" (*Areca catechu*) were found to be attacked by the black line fungus (*U. zonata*), supposedly the first record of such attack.

Moldy rot [of rubber trees], M. AMIN (*Agr. Bul. Fed. Malay States*, 8 (1920), No. 3, pp. 174, 175).—A rubber tree disease known as moldy rot attacks renewing bark, usually about an inch above the tapping cut and parallel thereto. The disease, which is ascribed to a *Sphaeronema*, is briefly discussed as to symptoms, point of attack, spreading agencies, treatment, and preventive measures.

Diseases of paper, P. SÉE (*Les Maladies du Papier Piqué. Paris: O. Doin & Son*, 1919, pp. 168, pls. 17, fig. 1).—This is a systematic treatment of diseases, discolorations, and other injuries of paper due to fungi, about 16 genera of which are dealt with in connection with the injury and control measures.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

Gopher control by means of calcium cyanid, G. E. SANDERS (*Agr. Gaz. Canada*, 8 (1921), No. 6, pp. 628, 629).—During the course of experimental control work with the gopher at Carlyle, Sask., a comparatively new cyanid containing approximately 50 per cent calcium cyanid and marketed in small flakes was found to give great promise. This cyanid is not nearly so deliquescent as sodium or potassium cyanids. Its physical form as well as its chemical constitution assist in its comparatively rapid decomposition when placed in contact with damp earth or less rapid on exposure to air, the products being hydrocyanic-acid gas and hydrated lime.

In testing its effectiveness, approximately 2.5 oz. of the material was inserted as far down the burrow as possible by means of a long-handled iron spoon, and weeds were then placed in the entrance of the burrow and covered with earth. Of 62 gopher burrows thus treated on July 11, not a single burrow had been opened 48 hours later. In another test in which 69 burrows in heavier land were treated in the same manner, but two had been opened 24 hours later. In a test where 12 burrow openings were treated with 1.5 oz. of the substance, only 2 had been opened 24 hours later.

This cyanid has the advantage of being as effective at one season as at another, so that, even though it may not compete economically with poisoned grain for spring use against the gopher, it should be a valuable adjunct for summer control.

The Ministry's research (rat) laboratory, C. L. CLAREMONT (*Jour. Min. Agr. [London]*, 28 (1921), No. 8, pp. 712-718).—This is an account of work against the rat being conducted in Great Britain.

Trapping, W. L. ARNOLD ([*Guilford, Me.*]: Author, 1921, pp. 51, figs. 15).—This is a small handbook with directions for trapping fur-bearing animals.

A mongoose in Kentucky, H. H. T. JACKSON (*Jour. Mammalogy*, 2 (1921), No. 4, pp. 234, 235).—The trapping of an individual *Herpestes griseus* near

Midway, Woodford Co., Ky., in November, 1920, is recorded. No explanation can be made of the origin of this mongoose.

Two new rodents from Oregon and Nevada, E. A. GOLDMAN (*Jour. Mammalogy*, 2 (1921), No. 4, pp. 232, 233).

Two unrecognized shrews from California, H. H. T. JACKSON (*Jour. Mammalogy*, 2 (1921), No. 3, pp. 161, 162).

Portraits and habits of our birds, edited by T. G. PEARSON (*New York: Natl. Assoc. Audubon Soc.*, 1920, vols. 1, pp. [X]+200, pls. 73, figs. 37; 2, pp. [X]+201-400, pls. 74, figs. 29).—Each of these volumes contains discussions, by well-known ornithologists, on the lives and habits of 50 birds. Most of the species discussed are illustrated by colored plates by L. A. Fuertes, R. B. Horsfall, E. J. Sawyer, A. Brooks, and R. I. Brasher, and photographs and drawings from nature.

The migration of North American birds, XVI, XVII, compiled by H. C. OBERHOLSER (*Bird Lore*, 23 (1921), Nos. 4, pp. 192-194, pl. 1; 6, pp. 295-299, pl. 1).—This commences the second series of papers on the subject (E. S. R., 45, p. 358), and records the migration of the purple grackle (*Quiscalus quiscula ridgwayi*), the rusty blackbird (*Euphagus carolinus*), and the brewer blackbird (*E. cyanocephalus*).

Mallophaga of our native birds, E. J. KOHL (*Ind. Acad. Sci. Proc.*, 1920, pp. 119-133, figs. 13).—This paper includes a key to the suborders and genera.

[**Economic ornithology**], E. H. FORBUSH (*Mass. Dept. Agr., Dept. Buls.* 1 (1921), pp. 51, figs. 26; 2 (1921), pp. 36, figs. 31; 6 (1921), pp. 20, figs. 9).—These bulletins deal, respectively, with outdoor bird study; food, feeding, and drinking appliances and nesting material to attract birds; and the English sparrow.

Community bird refuges, W. L. MCATEE (*U. S. Dept. Agr., Farmers' Bul.* 1239 (1921), pp. 14, figs. 3).—This publication, dealing with the establishment of community bird refuges, is adapted for use throughout the United States.

A memory-aid to parasitology, G. DICORATO (*Aide-mémoire de Parasitologie. Paris: Libr. E. Le François*, 1921, 2. ed., rev. and enl., pp. 62).—This small booklet brings together information on the general classification of the more important animal and fungus parasites of animals.

Insect transformation, G. H. CARPENTER (*London: Methuen & Co., Ltd.*, 1921, pp. X+282, pls. 4, figs. 124).—The several chapters of this work deal with form, growth, and change; the open type of wing growth; the hidden type of wing growth; some wingless insects; the class and orders of insects; growing insects and their surroundings; and the problems of transformation.

Studies on the respiration of insects, R. A. MUTKOWSKI (*Ann. Ent. Soc. Amer.*, 14 (1921), No. 2, pp. 150-156).—This paper deals with the gases and respiratory proteins of insect blood.

Rearing meal moths and parasitic wasps for experimental purposes, P. W. WHITING (*Jour. Heredity*, 12 (1921), No. 6, pp. 255-261, figs. 11).—In his genetic experiments with insects, the author has developed the methods which he here describes. The discussion relates to methods of rearing the insects; collecting the moths; the parasite *Habrobracon brevicornis* Wesm., as material for genetic experiments; etc.

Insect life, C. A. EALAND (*London: A. & C. Black, Ltd.*, 1921, pp. XII+340, pls. 74, figs. 13).—This is a popular account illustrated in large part by colored plates which contain as many as 47 species on a plate.

Insects and their injuries, E. DONGÉ and P. ESTIOT (*Les Insectes et Leurs Dégâts. Paris: Paul Lechevalier*, 1921, pp. CXXIX+115, pls. 100, figs. 91).—The first part of this book consists of a general account of insects, their anatomy, physiology, classification, and means of control. The main part of the work

(pp. 1-100) consists of summarized accounts of some 100 of the more important pests, each of which, together with the nature of its work, is illustrated in colors.

Some limiting factors in the use of fungus diseases for combating insect pests, R. D. GLASGOW and C. S. SPOONER (*Ill. State Acad. Sci. Trans.*, 13 (1920), pp. 303-310).—This general account includes a brief reference to investigational work conducted by the authors.

[Plant pest control legislation in Florida] (*Fla. Plant Bd. Circ.* 42 (1921), pp. 71, figs. 2).—The text of the Florida plant act of 1915 and the bee disease act of 1919, and rules and regulations made pursuant thereto by the State Plant Board of Florida, as in effect June 15, 1921, are presented.

Report of the entomological section, R. H. PETTIT (*Michigan Sta. Rpt.* 1920, pp. 275-277).—In the course of this report on the work of the year the author refers to the discovery that the serious attacks of the buffalo tree-hopper in Michigan, which sometimes occur in young apple trees, almost invariably follow the setting of new orchards in alfalfa or some plant that remains succulent late in the season, or at least the close proximity of some such succulent plant, usually alfalfa or in a lesser degree of red raspberries. These plants apparently furnish ideal feeding places for this tree-hopper late in the season, and the young trees furnish a natural place for oviposition. As a result, young trees under such conditions are often deformed or killed outright, whereas larger trees are able to withstand the attacks and escape with a few scars. In a note previously published¹ the author has referred to this discovery.

New pests which occurred in Michigan during the year include *Anametis griseus*, a snout beetle which attacks the bark and buds of apple and is also recorded from peach; the spruce tortrix *Argyrophora abietana*, which attacks the buds and tips of the twigs and binds them up with webbing, and is quite a serious enemy of ornamentals in Detroit and vicinity; and the spruce budworm (*Tortrix fumiferana*). The oriental peach moth appeared in the larval form in quantities in shipments from the South.

Division of insect suppression; plan and progress of work, 1919-1920, W. C. O'KANE (*N. H. Agr.*, 36 (1919-1920), pp. 65-89, pls. 4, figs. 8; also in *N. H. State Dept. Agr., Div. Insect Suppr. Circ.* 13 (1921), pp. 19, pls. 12).—The details of the work of the years 1919 and 1920 here presented include maps showing the present distribution of the more important parasites of the gipsy and browntail moths in New Hampshire, namely, *Anastatus bifasciatus*, *Schedius kavanaughae*, *Blepharipa scutellata*, *Compsilura concinnata*, *Apanteles melanoscelus*, *Limnerium disparis*, and *A. lacteicolor*, *Meteorus versicolor*, and *Zygobothria nidicola*, and of the Calosoma beetle *C. sycophanta*.

[Report of the] division of plant inspection, E. M. EHRHORN (*Hawaii Bd. Commrs. Agr. and Forestry [Bien.] Rpt.*, 1919-20, pp. 75-113, pls. 7).—This report includes a list of important insect pests which do not now occur in Hawaii, the introduction of which it is hoped to prevent.

Observations on the insects of grasses and their relation to cultivated crops, H. W. MILES (*Ann. Appl. Biol.*, 8 (1921), No. 3-4, pp. 170-181).—The observations here reported upon deal especially with those insects that, while using grasses for shelter or food, finally migrate to cultivated crops for the completion of their life history, for the development of later broods, or for food when the crop is at the critical state that satisfies their requirements.

Rice pests [in the Philippines], A. GOCO (*Philippine Agr. Rev.*, 14 (1921), No. 1, pp. 57-62, pls. 6).—Notes are here presented on the more important

¹ Jour. Econ. Ent., 13 (1920), No. 3, p. 323.

animal enemies of rice in the Philippines, including rats, birds, and insects. Particular mention is made of the rice bug (*Leptocorisa acuta*); the rice stem borer (*Schoenobius punctellus* Zell.); and several lepidopterous insects attacking the leaf, including a butterfly (*Melanitis ismeni* Cram), a small moth (*Cnapalocrosis medinales*), and two cutworms *Prodenia litura* Fab. and *Spodoptera mauritia* Boisdu.

Insect pests of orchard and vineyard, H. VON SCHILLING, rev. by L. REH (*Die Schädlinge des Obst- und Weinbaues. Frankfurt a. d. Oder: Trowitzsch & Son, 1920, 3. ed., rev. and enl., pp. 3+61, pls. 2, figs. 18*).—This is a popular summary of information on the more important insect enemies of fruit culture in Germany. Some 45 important pests are illustrated in 2 attached colored plates.

Orchard insect problems, J. J. DAVIS (*Ind. Hort. Soc. Trans., 1920, pp. 101-105*).—This is a brief discussion of the orchard insect problems met with in Indiana.

Some important insects which attack the avocado in Florida, G. F. MOZNETTE (*Calif. Avocado Assoc. Ann. Rpt., 1919-20, pp. 76-78*).—This is a brief account, information relating to which has been noted from other sources (E. S. R., 45, p. 551; 46, p. 351).

Insect pests in the cocoa store (*Bul. Imp. Inst. [London], 19 (1921), No. 2, pp. 189-200, pl. 1*).—After discussing the means by which infestation of cocoa beans takes place, a brief account is given of the more important insects concerned, the loss occasioned, and control measures.

Grasshopper report, A. V. MITCHENER (*Manitoba Dept. Agr. and Immigr. Ann. Rpt., 1920, pp. 14-19, figs. 2*).—This is a report on observations of grasshoppers in southern Manitoba in 1920 and control work conducted.

A sarcophagid parasite of the common field cricket, C. A. HERRICK (*Amer. Micros. Soc. Trans., 40 (1921), No. 3, pp. 116, 117*).—The author records the rearing of *Sarcophaga kellyi* Ald. from the black field cricket *Gryllus assimilis* Fab. at Manhattan, Kans., in September, 1920. Two larvae were discovered in the body cavity of crickets that were being dissected for nematodes, one of which larvae pupated within 24 hours after removal from its host, and the adult emerged 19 days later. An account of the parasitism of grasshoppers by this species, by Kelly, has been noted (E. S. R., 32, p. 60).

The periodical cicada, 1919; brief notes for the District of Columbia region, W. L. MCATEE (*Ent. Soc. Wash. Proc., 23 (1921), No. 9, pp. 211-213*).

The rice bug, *Leptocorisa acuta* Thbg., in the Philippines, L. UICHANCO (*Philippine Agr. Rev., 14 (1921), No. 1, pp. 87-125, pls. 4*).—The insect here considered is the most important of the insect enemies of rice in the Philippines, where during the months of its greatest abundance it has destroyed over one-half of the season's crop. Its classification, economic importance, life history and bionomics, and control measures are dealt with.

Control of the greenhouse white fly on tomatoes, L. LLOYD (*Expt. and Research Sta. Cheshunt Herts., Ann. Rpt., 6 (1920), pp. 16-26, 74, fig. 1*).—A brief account of this white fly and of control measures, particularly the cyaniding of tomato houses.

A study of the biology of the Chrysopidae, R. C. SMITH (*Ann. Ent. Soc. Amer., 14 (1921), No. 1, pp. 27-35*).—This account is based upon an intensive study of the Chrysopidae extending over a period of five years, a detailed report of which is now awaiting publication. The total life cycle of the Chrysopidae was found to require a period of approximately 25 to 50 days.

Controlling the rice borer (*Chilo simplex*) by submergence, C. HARUKAWA (*Ber. Ohara Inst. Landw. Forsch., 1 (1920), No. 5, pp. 599-628, fig. 1*).—Following the introduction, in which attention is called to the great loss suf-

fered by rice growers in Japan from the attack of this borer, the author deals with the factors governing the efficiency of submergence, the effect of immersion at varying temperatures, submergence in the rice field, and submergence and kerosene.

It was found that a temperature of 28 or 29° C. does not have any injurious effect upon the activity of *C. simplex*. A temperature of 35° (95° F.) is injurious to it, but 24 hours' exposure to this temperature kills only a small percentage of the rice borers, provided there is sufficient oxygen. As the temperature is raised above 35° the duration of exposure which is required to kill the rice borers decreases markedly, and at a temperature of 45° only 2 or 2.5 hours is required to kill all the worms.

"From the results of the experiments it is concluded that the killing by submergence in the rice field results from the combined action of the abnormal temperature and suffocation, and if the duration of submergence is 24 hours or less, the temperature of the water in the rice field plays a very important rôle, and a satisfactory result can probably not be expected unless the maximum temperature of the water reaches 34 or 35°. The writer can not yet make any definite estimate of the efficacy of submergence in the rice field from the data which he has obtained up to the last season. But he is inclined to think that under favorable conditions and good management we can kill about 50 per cent of the borers, and it may not be impossible to get even a better result."

Homoeosoma nebulella Hb., a pest of sunflowers in Rumania, L. REH (*Ztschr. Angew. Ent.*, 5 (1919), No. 2, pp. 267-277, figs. 3; *abs. in Rev. Appl. Ent.*, 8 (1920), Ser. A, No. 7, p. 274).—This paper relates to a lepidopterous enemy of sunflower seed in Rumania. The eggs are laid in sunflower heads when in bloom, and the emerging larvae feed on the blossoms and soft seeds.

Attachment of the abdomen to the thorax in Diptera, B. P. YOUNG (*New York Cornell Sta. Mem.* 44 (1921), pp. 255-306, figs. 77).—This is a report of anatomical studies of one or more species from 55 of the 59 families catalogued by Aldrich¹ and of one from each of the two additional families Sciaridae and Piophilidae. The study is accompanied by illustrations of the anatomy of 76 species.

The development of the ovary and ovarian egg of a mosquito, Anopheles maculipennis Meig., A. J. NICHOLSON (*Quart. Jour. Micros. Sci. [London]*, n. ser., 65 (1921), No. 259, pp. 395-448, pls. 4).—This is a detailed report of embryological studies conducted by the author, which includes a list of 34 references to the literature.

The anophelines of Denmark and malarial fevers, C. WESENBERG-LUND (*Compt. Rend. Soc. Biol. [Paris]*, 85 (1921), No. 26, pp. 386, 387).—Three species of *Anopheles* occur in Denmark, namely, *A. plumbeus*, which is rare; *A. bifurcatus*, which lives by preference in the forests and bites at nightfall; and *A. maculipennis*, which is rarely met with. Systematic investigations conducted by the author during a period of two years have shown that *A. maculipennis* lives in stables and outhouses, and only leaves for mating and oviposition. It sucks the blood of swine, cattle, and horses, and only attacks man when these animals are not available.

[**Mosquito and malaria control**] (*Pub. Health Serv. U. S., Pub. Health Bul.* 115 (1921), pp. 192, pls. 4, figs. 6).—Among the papers presented at the second annual antimalaria conference of sanitary engineers and others engaged in malaria field investigations and mosquito control, at Louisville, Ky., in November, 1920, the following are of interest to the economic entomologist: Mosquito-control Organization in Nassau County, Long Island, N. Y., by W. H. De Mott

¹ Smithsn. Inst. Pub. 1444 (1905), pp. 680.

(pp. 10-18); Service Policy and Administrative Methods in Malaria-control Investigations, by L. D. Fricks (pp. 25-30); Fish Control, by G. Parker (pp. 39-41); Agricultural Drainage and Its Relation to Malaria Control, by S. H. McCrory (pp. 56-60); The Organization of Malaria-control Division in State Board of Health, by L. M. Fisher (pp. 65-69); Railroad Malaria Work, by H. W. Van Hovenberg (pp. 77-79); Engineers and Malaria Control, by W. G. Stromquist (pp. 88-91); Oiling and Larvicides, by E. B. Johnson (pp. 99-103); The Part Biology Plays in the Dissemination of Malaria, by B. Mayne (pp. 114-121); Culex Control, by E. H. Magoon (pp. 129-131); and Malaria-control Drainage Project, Perry, Fla., by G. W. Simons, jr. (pp. 145-149).

The pear leaf curling midge, D. MILLER (*New Zeal. Jour. Agr.*, 23 (1921), No. 2, pp. 84-92, figs. 10).—Notes are presented on a pear leaf curling midge, thought to be *Perrisia pyri* Beche. This is a European pest causing injury to the foliage of pear trees at Avondale, near Auckland, first observed in New Zealand during the summer of 1916-17. So severe is the infestation in the Auckland district that nursery stock and young orchard trees up to 3 years of age are almost or completely defoliated and the growth thus practically arrested. Older trees up to 8 years of age also suffer severely, particularly on the terminal shoots, and the development of the fruit is also decidedly hindered.

The eggs hatch in 4 days, and the larvae attack the leaf, which 6 or 7 days later is totally black and commences to dry up and turn brittle. Just before the leaf hardens the larvae, which have matured, drop and burrow into the ground to a depth of 2 to 3 in., and from 10 to 14 days later emerge as adults. Thus the life cycle occupies a period of 25 to 30 days. An investigation of control measures is under way.

Notes on the life history of a crane fly of the genus *Geranomyia* Haliday (Tipulidae, Diptera), C. P. ALEXANDER and J. R. MALLOCH (*Ill. State Acad. Sci. Trans.*, 13 (1920), pp. 310-319, figs. 12).—This is a report of observations of *G. canadensis* (Westw.).

Note on the chemotropism of the house fly, W. R. G. ATKINS (*Ann. Appl. Biol.*, 8 (1921), No. 3-4, pp. 216, 217).—The note here presented relates to observations made at Abukir, on the north coast of Egypt, from 1916 to 1919, and confirm the observations of Imms and Husain (*E. S. R.*, 43, p. 553) and of Speyer (*E. S. R.*, 44, p. 458). It was found that formalin when diluted was at times very effective if exposed in a shallow dish near a window. The flies apparently drink in the morning as early as possible, and for this reason the formalin should be available at that time. Thousands of flies that were attracted from a neighboring village by the strong odor of butyl acetate afforded an example of chemotropism on a very large scale.

List of the Tachinidae (Diptera) of North Carolina, C. S. BRIMLEY (*Ent. News*, 33 (1922), No. 1, pp. 20-26).—This is a list of the species of Tachinidae known to have been recorded from North Carolina, including date, locality, and collector records, where known.

Frit fly (*Oscinis frit*) in winter wheat, F. R. PETHERBRIDGE (*Ann. Appl. Biol.* 7 (1921), No. 4, pp. 363-366).—In the present paper the author shows that bad attacks of *O. frit* on winter wheat following rotations containing either rye grass or Italian rye grass, as previously reported (*E. S. R.*, 38, p. 460), are due to the fact that the autumn brood of flies lay their eggs on the grass. The larvae from these feed on the shoots, and after the grass is plowed under in the fall they eventually migrate to the young wheat plants. The plowing in of the rye grass in August prevented a loss of wheat from its attack.

Spraying trial for control of logan beetle, A. H. LEES and G. S. PEREN (*Univ. Bristol, Agr. and Hort. Research Sta. Ann. Rpt.*, 1920, pp. 74-77; also

in *Jour Bath and West and South. Counties Soc.*, 5. ser., 15 (1920-21), pp. 148-251).—The logan and raspberry beetle (*Byturus tomentosus*) is the worst pest with which logan growers of Great Britain have to deal and is the most usual cause for grubbing up otherwise fruitful plantations. The authors report that application on May 19 and again on May 27 of a spray consisting of arsenate of lead 6 lbs., soft soap 10 lbs., and water 100 gal., at a pressure of 125 lbs. to the square inch, reduced the total infestation from 24 to 15 per cent. The number of infested berries in the control portions increased markedly as the season progressed, and the effect of the spray became less marked, thus indicating the desirability of a third application.

The fauna of British India, including Ceylon and Burma, edited by A. E. SHIPLEY and G. A. K. MARSHALL (*London: Taylor & Francis, 1919, pp. XI+439, figs. 130*).—In this part of the work previously noted (*E. S. R.*, 43, p. 50) the Hispidinae and Cassidinae of the Chrysomelidae are dealt with by S. Maulik.

A white grub (*Holotrichia leucophthalma* Wied) injurious to Hevea, P. ARENS (*Arch. Rubbercult. Nederland. Indië*, 3 (1919), No. 10, pp. 437-453, pls. 2; also in *Meded. Proefsta. Malang*, No. 28 (1919), pp. 13, pls. 2).—The grubs of *H. leucophthalma* injure the stumps of Hevea in Java in the same way that *Lepidiota pinguis* injures Hevea stumps in Ceylon, as reported by Green, namely, by eating all the rootlets and decortivating the taproot. A year is said to be required for the completion of the life cycle of this beetle, the incubation period of the egg varying from 25 to 29 with an average of 27 days, the larval period lasting about 8 months, and the pupal period from 27 to 34 with an average of 29 days.

A new cerambycid beetle from California, W. S. FISHER (*Ent. Soc. Wash. Proc.*, 23 (1921), No. 9, pp. 206-208).

Melanotus hyslopi n. sp. (Coleop.), R. H. VAN ZWALUWENBURG (*Ent. Soc. Wash. Proc.*, 23 (1921), No. 9, pp. 210, 211).

Howardula benigna; a nema parasite of the cucumber beetle, N. A. COBB (*Science*, n. ser., 54 (1921), No. 1409, pp. 667-670, figs. 4).—A nematode which occurs commonly in the body cavity, including the abdomen, thorax, and even the head, of *Diabrotica vittata* Fab., *D. trivittata* Mann, and *D. 12-punctata*, especially the first-named, and infesting the two sexes about equally, is described as new. Its distribution in 1921 appears to be nearly coextensive with that of *D. vittata* and *D. trivittata*, its main hosts. The nematism is often high and affects on an average about 20 per cent of the insects. Studies indicate that the infested female beetles are smaller, less vigorous, and less fertile than the noninfested.

North American Ipidae of the subfamily Micracinae, with descriptions of new species and genera, M. W. BLACKMAN (*Mississippi Sta. Tech. Bul.* 9 (1920), pp. 3-62, pls. 5).—This report is based upon collections and field studies in Mississippi made during the winter and spring of 1919-20, from November 1 to June 1. The results, which are here presented as a contribution toward a revision of the North American Micracinae, include keys to the five genera of this subfamily, namely, Micracis, Thysanoes, Pseudothysanoes n. g., Cryptocleptes n. g., and Erineosinus n. g. The subgenus Micracisoides is erected, and 13 species are described as new. A bibliography of 27 titles is included.

Descriptions of eight new bark beetles (Ipidae) from Mississippi, M. W. BLACKMAN (*Mississippi Sta. Tech. Bul.* 10 (1921), pp. 16, figs. 10).—This consists of descriptions of new species of Ipidae collected during the course of the work above noted. These are *Phthorophloeus dentifrons*, from their burrows in dead limbs and twigs of hackberry (*Celtis mississippiensis*) from Agricultural College and from *Celtis* sp. from Lawrence, Kans.; *P. mississippiensis*

from their burrows in the bark of dying wild plum (*Prunus angustifolia*) from Agricultural College; *Phloeosinus enixus* from the bark of *Juniperus virginiana* from four localities in the State; *Pseudopityophthorus gracilus* from the bark of small dead limbs of water oak (*Quercus nigra*) and *Quercus* sp. from Natchez; *Pityophthorus scriptor* from the bark of sumach (*Rhus hirta*) from three localities; *P. natalis* from beneath the bark of dead limbs of red bud (*Cercis canadensis*) from Agricultural College; *P. liquidambarus*, from beneath the bark of limbs of the sweet gum (*Liquidambar styraciflua*) from five localities in the State and from Mound, La.; and *Pityogenes meridianus* from their burrows in loblolly (*Pinus taeda*) and shortleaf pine (*P. echinata*) from three localities in the State.

On the life history of wireworms of the genus *Agriotes* Esch., with some notes on that of *Athous haemorrhoidalis* F., A. W. R. ROBERTS (*Ann. Appl. Biol.*, 8 (1921), No. 3-4, pp. 193-215, pl. 1, figs. 4).—This second part of the paper previously noted (*E. S. R.*, 42, p. 855) consists of descriptions of the several stages of *Agriotes obscurus*.

Eradication of the sweet-potato weevil in Florida, J. E. GRAF and B. L. BOYDEN (*U. S. Dept. Agr., Dept. Circ.* 201 (1921), pp. 13, figs. 2).—This is a progress report on the eradication work that has been conducted on the Baker-Charlton area in Florida and Georgia, in cooperation with the Florida State Plant Board. The inception and plan of the work, the manner in which it has been conducted, and the results obtained during the past three years are described. The results are considered to have amply justified predictions based upon the preliminary survey and offer convincing proof that the same methods, followed with care, will be successful in eradicating the sweet-potato weevil in almost any infested locality where abundant wild food plants do not offer a fresh and continuous source of infestation. It is also said that careful sorting of the crop, the use of clean planting stock, and an annual change of location for the main planting will reduce infestation of the tubers to a practically negligible quantity.

The strawberry crown borer (*Tyloclerma fragariae* Ril.), H. GARMAN (*Kentucky Sta. Circ.* 27 (1921), pp. 27-34, figs. 2).—This enemy of the strawberry has recently assumed greater importance, particularly in Warren and adjacent counties of Kentucky, where the acreage of strawberries has rapidly increased. The present paper, which is a more extended account of the pest than that given in Bulletin 31 of the station (*E. S. R.*, 2, p. 405), records the results of later experiences and of observations made during the season of 1921.

Inspections made by the author in October, 1921, showed three fourths or more of the commercial plantings about Bowling Green to be infested, and the old ones very badly so. The pest is known to attack no cultivated crop beside the strawberry, and since without doubt it originally fed upon the wild strawberry, it being a native insect, these plants should be destroyed on land before starting a bed where they occur. There appears to be no record of its feeding upon any weed growing on cultivated ground. Those most likely to harbor it are members of the same botanical family, Rosaceae, a number of which grow on cultivated ground at Bowling Green and elsewhere in the State, brief accounts being given by the author of eight such plants.

The suggestions for treatment made by the author include the starting of new beds 150 or more yards from infested beds, the use of only young plants formed from runners during the preceding summer and, if possible, from beds that are not infested, and the destruction of old beds as soon as practicable after they are no longer profitable by plowing up and raking off and burning

them in July or August. In the case of slightly infested beds that are still profitable for berries, spraying in late August and early September with 1.5 lbs. of arsenate of lead powder in 40 gal. of water may be helpful as a means of keeping the borer in subjection until the plants can be plowed up and destroyed, since it is now known that the adult beetles feed freely on the leaves.

The hawthorn blossom weevil (*Anthonomus nebulosus* Lec.), W. H. WELLHOUSE (*Ann. Ent. Soc. Amer.*, 14 (1921), No. 2, pp. 141-144, fig. 1).—The hosts of this weevil include a number of the larger species of hawthorn, such as *Crataegus punctata*, *C. brainerdi*, *C. pruinosa*, and *C. mollis*, and it is probably found wherever its hosts appear, east of the Rocky Mountains. The injury caused by it is most apparent while the trees are in full bloom, at which time infested blossoms are brown and remain closed. Notes are presented on its life history and habits. The life cycle from egg to appearance of the adult is passed in from 27 to 35 days.

Apiculture of the time of Aristotle, J. KLEK and L. ARMBRUSTER (*Arch. Bienenkunde*, 1 (1919), No. 6, pp. 56, pl. 1).—This consists of translations from the writings of Aristotle, with an introduction, notes, etc., by the authors.

Twentieth annual report of the Illinois State Beekeepers' Association, compiled by G. M. WITHROW (*Ill. Beekeepers' Assoc. Ann. Rpt.*, 20 (1920), pp. 208, figs. 17).—This includes a report of the proceedings of the thirtieth annual meeting of the association, held at Springfield, Ill., in December, 1920 (pp. 7-100), and also a report of the proceedings of the twenty-fourth annual convention of the Chicago-Northwestern Beekeepers' Association, held at Chicago, Ill., in December, 1920 (pp. 101-182).

Every step in beekeeping, B. W. DOUGLASS (*Indianapolis: Bobbs-Merrill Co.*, 1921, pp. [VII]+177, pls. 31).—This is a popular account of apiculture.

Complete course in apiculture, G. DE LAYENS and G. BONNIER (*Cours Complet d'Apiculture. Paris: Libr. Gén. de l'Enseignement, new ed., rev.*, pp. 445, figs. 246).—The principles and practice of beekeeping are dealt with.

Key for the separation of the Bremidae, or bumblebees, of Illinois, and other notes, T. H. FRISON (*Ill. State Acad. Sci. Trans.*, 12 (1919), pp. 157-165).—This article includes keys for the separation of males, queens, and workers of 16 species of *Bremus* and 4 species of *Psithyrus* from Illinois.

Heredity in wasps.—A study of heredity in a parthenogenetic insect, the parasitic wasp, *Hadrobracon*, P. W. WHITING (*Jour. Heredity*, 12 (1921), No. 6, pp. 262-266, figs. 3).—This paper is based upon studies of *H. brevicornis* Wesm., a parasite of the Mediterranean flour moth. This parasite is easily manipulated and passes through a generation in 10 days in the incubator, 350 or 400 offspring often being produced from a single female.

Studies on the parasitic wasp *Hadrobracon brevicornis* (Wesm.), I, II, P. W. WHITING (*Biol. Bul. Mar. Biol. Lab. Woods Hole*, 41 (1921), Nos. 1, pp. 42-54; 3, pp. 153-155).—This paper deals with the genetics of an orange-eyed mutation and the production of mosaic males from fertilized eggs.

On the bionomics and post-embryonic development of certain cynipid hyperparasites of aphids, M. D. HAVILAND (*Quart. Jour. Micros. Sci. [London]*, n. ser., 65 (1921), No. 259, pp. 451-478, figs. 11).—"Bothryoxysta curvata Kieff., *Charips victrix* Hart., and *Alloxysta erythrothorax* Westw. are hyperparasites of aphids through *Aphidius* (Braconidae). Reproduction may be either sexual or parthenogenetic. The egg is laid in the haemocoel of the host larva before the death of the aphid, and post-embryonic development is internal. A trophic membrane of hypertrophied cells is formed round the embryo. The larva is, at first, hypermetamorphic and exhibits greater development of the chitinous cuticle than is usual in endoparasites, but in the succeeding stages it

approximates more closely to the general hymenopterous type. The development of the Aphidius is arrested at a certain point, and metamorphosis does not take place. The cynipid, when ready to pupate, makes its way out of the Aphidius, whose remains it devours, and undergoes metamorphosis within the cocoon previously woven by the latter in the skin of the aphid. These forms differ in certain particulars from the entomophagous Cynipidae previously described, and the chief differences are discussed. Comparison is also made of the larvae of other Hymenoptera parasitica, particularly of *Perilampus*. Certain problems of metabolism are pointed out, and it is suggested that respiration may be partly rectal. These Cynipidae are economically injurious as they check the Aphidius in its destruction of plant lice, but there is high mortality among the larvae owing to secondary parasitization of the braconid by other hyperparasites."

A list is given of 27 references to the literature.

Observations relative to recent recoveries of *Pleurotropis epigonus* Walk. (Hym.), J. S. WADE and P. R. MYERS (*Ent. Soc. Wash. Proc.*, 23 (1921), No. 9, pp. 202-206).—All known records of the distribution of this parasite of the Hessian fly, introduced from Europe in 1891 and 1894 and released in three States and in Canada, are listed. It has become one of the common parasites of the Hessian fly throughout Maryland, Pennsylvania, New Jersey, and New York, but apparently is more abundant in New York than in any of the other States mentioned. An account of this parasite by McConnell has been noted (*E. S. R.*, 35, p. 760).

Some suggested homologies between larvae and adults in sawflies, W. MIDDLETON (*Ent. Soc. Wash. Proc.*, 23 (1921), No. 8, pp. 173-192, figs. 25).

North American Ichneumon flies of the genera *Clistopyga* and *Schizopyga*, R. A. CUSHMAN (*U. S. Natl. Mus. Proc.*, 60 (1921), Art. 4, pp. 1-14, figs. 14).

Notes on acarine disease, I-VII, J. RENNIE (*Bee World*, 2 (1921), No. 12, pp. 144, 145; 3 (1921), Nos. 1, pp. 5-7, figs. 3; 2, pp. 35, 36; 3, pp. 66, 67; 4, pp. 95, 96; 5, pp. 115-117, figs. 7; 6, pp. 145, 146).—This paper deals with an affection of adult bees caused by *Tarsonemus woodi* Ren., which passes its life cycle, from egg to adult, in the thoracic tracheae. Upon attaining maturity the mites pass to the outside of the bee, where they may be found creeping among or clinging to the hairy covering. This parasitic mite attacks the worker, drone, and queen bees, causing a progressive weakness of the whole body. Nearly 50 per cent of the queens heading acarine infested stock are themselves infested with the parasite. The drone appears to be an important agent in the spread of this parasite, since it becomes readily infested and may be highly infested with the migratory parasites while still capable of flight. The blocking of the tracheae restricts the supply of oxygen and causes a deterioration of the tissues directly connected. Weakened bees continue working, sometimes for a long period, but eventually become unable to fly and cease to share in the activity of the colony, becoming not only useless members but a burden upon the colony. Twenty-seven counties of England in which the disease was found in January and February, 1921, are listed. The possible elimination of the disease and the apparent survival of the queen are discussed.

On the mite (*Acarapis woodi* Ren.) associated with Isle of Wight bee disease, S. HIRST (*Ann. and Mag. Nat. Hist.*, 9. ser., 7 (1921), No. 42, pp. 509-519, figs. 7).—The present paper gives a detailed description of this mite, of which the honeybee is the host. Observations indicate that only adult bees are infested by this mite, which lives in the tracheal tubes of the thorax. While the manner in which infestation takes place is not known, it is thought that it may possibly occur while bees are visiting the same flower or drinking

place. It is pointed out that while the many species of Tyroglyphidae have a migratory or traveling stage (hypopus), this stage is not known to occur in the Tarsonemidae. Since the hypopus stage is always a nymph and there is no free nymphal stage either in Acarapis or Tarsonemus, it is probable that the disease spreads through the adult mite. The mites continue to live for several days after the death of the bee, and the great majority of them seem to die finally without leaving the body of the host. Occasionally a few adult mites may be found moving about on the dead bodies of the bees.

The action of chloropicrin on *Argas reflexus* Fab., P. REMY (*Compt. Rend. Acad. Sci. [Paris]*, 172 (1921), No. 25, pp. 1619-1621).—Preliminary experiments show that *A. reflexus* is destroyed by exposure for 24 hours to chloropicrin gas used at the rate of from 20 to 30 gm. per cubic meter.

Ticks infesting domestic animals in Southern Rhodesia, R. W. JACK (*Rhodesia Agr. Jour.*, 18 (1921), No. 4, pp. 361-371, figs. 16).—This is a general summary of information.

New genera and species of Protura, H. E. EWING (*Ent. Soc. Wash. Proc.*, 23 (1921), No. 9, pp. 193-202, figs. 13).

Typha insects: Their ecological relationships, P. W. CLAASSEN (*New York Cornell Sta. Mem.* 47 (1921), pp. 463-531, figs. 86).—The first part of this paper deals with the ecology of the genus *Typha*, of which the species *T. latifolia* and *T. angustifolia* occur in the United States. The second part deals with the life history and bionomics of the insect inhabitants of the plant. In the third part, which consists of a résumé, an attempt has been made to bring out the true ecological relationships, grouping the insects with reference to the parts of the plant they affect, their relative importance, and their inter-relations.

Those found on cat-tail and studied during the investigation include 6 species of Lepidoptera, 2 of Coleoptera, 8 of Hemiptera, 5 of parasitic Hymenoptera, and 4 of Diptera. The principal species are the lepidopterans *Arzama obliqua* Wlk. and *Nonagria oblonga* Grt., which mine in the leaves and later in the stems of *T. latifolia*; *Arsilonche albovenosa* Goeze, which feeds on the surface of the leaves; *Archips obsoletana* Wlk., which feeds on the immature heads; *Lymnaecia phragmitella* Staint., which attacks the head of the plant of both species of *Typha* and is the most common and abundant of all; and *Dicymolomia julianalis* Wlk., which lives in the head. The Coleoptera species are *Calendra pertinax* Oliv., which attacks the rhizome, and *Notaris puncticollis* LeC. The lygaeid *Ischnorrhynchus resedae* Panz., which feeds upon the dry seeds, was also studied.

A bibliography of 23 titles is included.

FOODS—HUMAN NUTRITION.

Food values: How foods meet body needs, E. A. WINSLOW (*U. S. Dept. Agr. Bul.* 975 (1921), pp. 37, figs. 50).—The purpose of this bulletin is to bring out some important and well-established facts regarding the protein, phosphorus, calcium, and iron content of foods and their fuel value by new and graphic methods.

It has been usual to present such data chiefly by means of figures and in terms of percentages, but in this bulletin, in addition to the older method, the facts are presented in diagrams which show the proportion of the total daily requirement of protein, energy, iron, calcium, and magnesium a pound of each of fifty common foods will supply. The foods are divided into five food groups in accordance with the method outlined in other publications of the Department.

The way in which these diagrams can be used in computing foods is explained, and suggestions are made with reference to the use of the material here presented in home and classroom.

A chemical study of certain Pacific Coast fishes, D. B. DILL (*Jour. Biol. Chem.*, 48 (1921), No. 1, pp. 73-82).—Analyses are reported of a number of California mackerel from the same catch and of various fish of the mackerel family, including yellow fin tuna, blue fin tuna, striped tuna, bonita, and albacore. The data presented show large and erratic variations in the composition of different individuals of the same species, thus indicating the limited value of data on the composition of fish based upon two or three analyses only. In a special study of mackerel no evidence could be detected of a connection between sex and composition or between fat content and approach of the spawning season. In general the fat content tended to increase during the summer and early fall.

A chemical study of the California sardine (*Sardinia caerulea*), D. B. DILL (*Jour. Biol. Chem.*, 48 (1921), No. 1, pp. 93-103).—Continuing the study noted above, analyses are reported of the California sardine, *S. caerulea*, based on composite samples of 10 fish each. The data include the monthly average composition of the sizes known when packed as quarters, halves, small ovals, and large ovals, and the composition of 10 different sardines of approximately the same weight. The latter table shows striking variations in composition of individuals, particularly in the fat content. This varied from 0.09 to 4.66 per cent, averaging 0.89 per cent. Small sardines were found to have a maximum fat content in the summer months, while in large sardines the maximum occurred in December and the minimum in May. With some exceptions the fat content increased with increasing size of the fish. No evidence was obtained that the growth of the reproductive organs draws to any extent on the reserve store of fat, or that there is any relation between the percentage of fat and the temperature of the water in which the fish are found. Appreciable amounts of glycogen were found in the flesh of the sardine.

Brine freezing of fish, H. F. TAYLOR (*U. S. Dept. Com., Bur. Fisheries Econ. Circ.* 53 (1921), pp. 8).—Attention is called in this circular to the importance of brine freezing in the economic distribution of fish. The technique of the method is described with suggested improvements.

The methods of fish canning in England, J. JOHNSTONE (*Min. Agr. and Fisheries [London], Fishery Invest.*, 1. ser., 2 (1921), No. 1, pp. 25).—This report summarizes the results of work done for the Ministry of Agriculture and Fisheries of Great Britain during 1919-1920 with regard to the utilization of the fish obtainable along the coast of England. The subject matter includes data on the chemical composition of fresh and cured herrings, sprats, whitebait, and mackerel; a discussion of the seasonal variation in the composition of the fish, the nature of maturation in canned fish, and the preservation of the fish before canning; and suggestions for improvements in methods of canning. A list of literature references on fish canning and related subjects is appended.

[Examination of dried eggs], Z. N. WYANT (*Michigan Sta. Rpt.* 1920, p. 246).—The bacteriological analyses of two samples of dried eggs is briefly reported. The bacteria content per gram was 40,000,000 in one sample and 60,000,000 in the other, or well within the permissible limit. The moisture, fat, protein, and ash content of the samples is also given.

Indian corn or maize, C. W. MEADE (*Nat. Hist.*, 21 (1921), No. 4, 409-413, figs. 4).—Information is summarized regarding the prehistoric and later use of Indian corn in the Western Hemisphere. Some early recipes are quoted on the use of corn as food. Among other things the author points out that although

specimens of corn have survived from prehistoric times in apparently perfect condition the grain has completely lost its power of germinating, all popular beliefs to the contrary notwithstanding.

[“Mummy” wheat, prehistoric corn, and ancient methods of preparing food] (*Nat. Hist.*, 21 (1921), No. 4, pp. 436, 437).—In a note supplementing the above article claims of marvelous longevity of wheat and many other seeds are discussed, the conclusions being that such claims are entirely without foundation. Some information is given about foodstuffs and their preparation in prehistoric times.

Among other prehistoric material obtained in Chile was “a bag filled with popcorn, as fresh in appearance as though but just roasted by a street vender.” “Among the west coast Indians of South America a specially shaped dish with a depression in the center for the reception of the grains and an attached handle for the comfort of the holder was used in popping corn.”

Cassava starch, C. GRIMME (*Ztschr. Untersuch. Nahr. u. Genussmtl.*, 41 (1921), No. 7-8, pp. 172-175).—Analyses are reported of the starch from the bitter and sweet cassava roots, and of the ash from the starch.

As compared with other kinds of starch, cassava or manioc starch is characterized by a high content of potassium and phosphorus. Viscosity determinations of different varieties of starch are also reported. These show that as a thickening agent cassava starch has about the same properties as cornstarch, is slightly better than rice and palm sago, and slightly poorer than arrowroot and potato starches.

Bacteriological studies on vegetables (*Kansas Sta. Rpt.* 1920, pp. 40, 41).—In continuation of the bacteriological studies on canned asparagus previously noted (*E. S. R.*, 44, p. 206), it is reported that *Bacillus subtilis* predominated in the jars to which a small amount of salt had been added, while *B. mesentericus* predominated in jars containing larger amounts of salt and smaller amounts of acid. A study of the influence of various amounts of air upon growth and thermal death points of the aerobes most commonly present in canned foods led to the conclusion that merely sealing the container almost completely inhibits the growth of these organisms, that the amounts of salt and acid used in the experiments cause practically no decrease in the number of spores up to 37 days at 37° C. in sealed containers containing various amounts of air, that increasing the amount of salt and decreasing the amount of air have no influence upon the thermal death point, but that increasing the amount of acid has a marked influence, the addition of 0.1 per cent of acid reducing the thermal death point nearly 50 per cent.

A rapid method of determining the presence and type of botulinus toxin in contaminated foods, P. F. ORR (*Jour. Infect. Diseases*, 29 (1921), No. 3, pp. 287-290).—The author is of the opinion that the method for determining the presence and type of botulinus toxin proposed by Graham and Schwarze, (*E. S. R.*, 45, p. 870), is unreliable, as in his experience it has been found possible to produce botulism in chickens by feeding foods infected with type B as well as type A toxin. The method recommended in this paper is the intraperitoneal injection in each of a number of white mice of about 0.5 cc. of the filtrate of the infected food, some of the mice having been previously injected with type A and some with type B antitoxin. In this way both the presence and type of toxin may be determined in from 4 to 6 hours. As a further precaution, it is recommended that some mice be inoculated with larger quantities, up to 1 cc., of the suspected filtrate. Attention is called to the distinct specificity of the toxin and antitoxin of the two types and the consequent importance of using specific type antitoxin in the treatment of botulism.

Poisoning from *Bacillus botulinus*.—Cause, prevention, treatment, Z. N. WYANT (*Michigan Sta. Circ.* 47 (1921), pp. 3–8).—A general discussion of the subject.

Volume variation of bottled foods, H. RUNKEL and J. C. MUNCH (*U. S. Dept. Agr. Bul.* 1009 (1921), pp. 20, figs. 2).—Such questions as causes of variation in volume of food in bottles, good commercial practice in bottling, and calculated variations in volume of bottles are discussed, and experimental studies are reported of the variation in capacity of bottles and in the volume of bottled foods, and in the relation between the calculated maximum variation and temporary methods of meeting the declared volume; as well as the matter of the practical application of the results. One reason for the importance of such questions is the fact that the Net Weight Amendment to the Federal Food and Drugs Act and many State laws require that food in package form bear a statement of the quantity of contents.

As pointed out in the authors' summary, "good commercial practice in bottling foods has been considered in this bulletin to be the attainment of conditions in the bottler's state of business in which he (a) includes in his orders for bottles the specifications as to capacity when filled to a specified height, (b) tests representative samples of every lot of bottles received, rejecting those appreciably under capacity, (c) fills his bottles to a height determined from the results of his tests, and (d) has his labels printed with a definite, correct statement of the quantity of contents and applies them unaltered. . . . Data on the capacity of bottles and volume of food in bottles indicate that only a small percentage of the bottles of food filled in accordance with good commercial practice, as outlined in this bulletin, should vary in quantity of contents by more than the calculated maximum variations."

A dietary study of some Kansas institutions under the control of the State Board of Administration, E. H. S. BAILEY (*Topeka, Kans.: State, 1921, pp.* 70).—Information is given regarding the food consumption per capita per day in nine public institutions in Kansas. The table which follows summarizes the results:

Per capita per day consumption of the average dietaries of nine State institutions.

Institution.	Period.	Weight of food.	Pro- tein.	Fat.	Carbo- hy- drates.	Fuel value.	Cost.	Cost per 1,000 calo- ries.
		<i>Pounds.</i>	<i>Grams.</i>	<i>Grams.</i>	<i>Grams.</i>	<i>Calories.</i>	<i>Cents.</i>	<i>Cents.</i>
Penitentiary, Lansing..	July, 1917, to Jan., 1918.	5.93	147	223	673	5,389	39.5	7.4
Industrial School for Boys, Hutchinson.	July, 1917, to Mar., 1918.	4.49	122	108	639	4,032	27.0	6.8
Hospital, Osawatomie..	July, 1917, to May, 1918.	3.27	83	102	412	2,911	21.9	7.6
Industrial School for Girls, Beloit.	Sept., 1917, to Sept., 1918.	4.58	91	106	430	3,113	17.5	5.8
Hospital, Topeka.....	Oct., 1917, to Oct., 1918.	3.40	87	96	418	2,927	23.6	8.1
Hospital, Parsons.....	Oct., 1918, to Oct., 1919.	4.70	101	109	481	3,355	33.0	9.9
School for the Blind, Kansas City.	Jan., 1919, to Jan., 1920.	3.67	72	92	366	2,668	38.0	11.5
Training School, Win- field.	July, 1920, to Jan., 1921.	4.87	96	100	470	3,188	29.0	9.1
School for the Deaf, Clathea.	Sept., 1920, to Jan., 1921.	4.27	98	144		3,524	37.7	10.7

In discussing the results of this survey, the author states that even when sufficient wholesome food is purchased the best results can not be obtained unless great care is taken in the menu for each day.

"The place and manner in which the food is served have much to do with stimulating the appetite and aiding digestion. A damp, poorly-lighted basement should never be used as a dining room. Circumstances have made this necessary in some instances, but clean, well-lighted dining rooms should be provided."

The vitamins, H. C. SHERMAN (*Physiol. Rev.*, 1 (1921), No. 4, pp. 598-630).—In this review the discussion is confined chiefly to such of the work upon vitamins as is of present importance to normal physiology. Each of the three recognized vitamins is discussed as to its physiological significance in normal nutrition and the disturbances following the use of a diet deficient with respect to the vitamin in question, its distribution in the body and foods, and its physical and chemical properties. A bibliography of 230 titles is appended.

Vitamin studies.—VIII, The effect of heat and oxidation upon the antiscorbutic vitamin, R. A. DUTCHER, H. M. HARSHAW, and J. S. HALL (*Jour. Biol. Chem.*, 47 (1921), No. 3, pp. 483-488, figs. 3).—The scorbutic diet for guinea pigs used in the present study consisted of unhulled oats 60 per cent and chopped alfalfa hay 40 per cent, the latter being autoclaved for 30 minutes at 15 lbs. pressure and dried before mixing with the oats. Guinea pigs were fed this diet plus 3 cc. of orange juice [twice the minimal protective dose as determined by Davey (*E. S. R.*, 45, p. 869)], either fresh or treated in various ways to determine the effect of heat and oxidation.

The results obtained indicate that this amount of orange juice showed no appreciable destruction by heating at a pasteurization temperature of 63° C. for 30 minutes in closed vessels or by boiling at 100° for 30 minutes under a reflux condenser, but that appreciable destruction of the antiscorbutic vitamin resulted from the addition of hydrogen peroxid to the orange juice at room temperature, and that the destructive action was increased on heating to 63 and 100°. The authors conclude that "the antiscorbutic properties of orange juice are susceptible to oxidation but, in the absence of oxidizing agents, are stable to heat up to the boiling temperature of orange juice."

Fat-soluble vitamin.—IX, The incidence of an ophthalmic reaction in dogs fed a fat-soluble vitamin deficient diet, H. STEENBOCK, E. M. NELSON, and E. B. HART (*Amer. Jour. Physiol.*, 58 (1921), No. 1, pp. 14-19, figs. 3).—Continuing the series previously noted (*E. S. R.*, 46, p. 257), seven dogs from the same litter were fed a daily basal ration consisting of 200 cc. of centrifuged milk heated for one hour at 15 lbs. pressure, 5 gm. of precipitated calcium phosphate, 2 gm. of sodium chlorid, 5 gm. of casein, and a mash of equal parts of rolled oats and white corn meal prepared by cooking in a pressure cooker at 15 lbs. pressure for one hour. The ingredients to be given in definite amounts were fed with a small part of the mash, after which mash and water were furnished ad libitum. Three of the animals received the basal ration with no addition, 2 with 20 gm. of fresh cabbage daily, and 2 with 5 cc. of cod liver oil for the first 17 days and 10 cc. thereafter.

On the basal ration alone 2 animals died without signs of ophthalmia, but in 1 case from an acute pneumonic inflammation similar to that observed in rats on a vitamin A-deficient diet. The third animal developed an ophthalmia after 94 days, but was cured by the administration for 6 days of an ether extract of 30 gm. of saponified cod liver oil. The 2 on the basal ration supplemented with cabbage developed typical ophthalmia after 67 and 83 days, respectively. One died shortly thereafter, while the other was cured by the daily administration of 20 cc. of cod liver oil. Photographs are included showing the typical ophthalmic reaction in 2 of the experimental animals.

Prepared flours and the question of vitamins, E. PERROT and R. LECOQ (*Bul. Sci. Pharmacol.*, 28 (1921), No. 4, pp. 177-191, figs. 6).—The authors have

determined the food value of 24 brands of commercial prepared flours and infant foods by means of chemical analyses and biological tests with rats, using the flour cooked with water as the sole food.

The results of these studies showed that while many of the preparations were of satisfactory chemical composition with regard to the known constituents, all but one were of low value biologically as shown by the growth curves of the experimental animals. An urgent plea is made that the food manufacturer make use of present available knowledge concerning food factors, and so revise the formulas and methods of manufacture that the necessary vitamins be included in the prepared flour and not destroyed in the manufacturing process.

The sensitiveness to poisons in avitaminous animals, W. STORM VAN LEEUWEN and F. VERZÁR (*Jour. Pharmacol. and Expt. Ther.*, 18 (1921), No. 4, pp. 293-311, figs. 7).—The object of the experiments reported in this paper was to determine whether a decrease of sensitiveness of smooth muscle to chemical agents normally present in the body could be responsible for part of the severe symptoms occurring in animals suffering from lack of vitamins.

It was found that the reaction of polyneuritic fowls and cats to adrenalin, histamin, and cholin, as determined by the action on blood pressure, and to atropin as determined by the inhibition of vagus stimulation, and the reaction of the isolated intestine and esophagus of these animals to pilocarpin, atropin, histamin, and cholin did not differ materially from similar reactions of normal animals. The authors conclude that the decreased activity of smooth muscle in polyneuritis is caused by a lack of the normal stimulating chemical agents and not by decreased sensitiveness.

Further contribution to the knowledge of foods with specific action, III-V, E. ABDERHALDEN (*Pflüger's Arch. Physiol.*, 185 (1920), No. 1-3, pp. 141-146; 187 (1921), No. 1-3, pp. 80-89, fig. 13; 188 (1921), No. 1-3, pp. 60-66, figs. 4).—These three papers continue the series previously noted (E. S. R., 44, p. 559).

Evidence is presented in the first paper (No. III), by the senior author and L. Schmidt, that the muscles of polyneuritic pigeons show a lowered tissue respiration, and that likewise muscles wasted through other diseases exhibit the same phenomenon. The addition of dried yeast, pigeon muscle preparation, and an alcoholic extract of yeast increased the oxygen consumption of fresh wasted muscle to three or four times the normal figure, while in the nonwasted muscle of sick or healthy pigeons the addition of these extracts was without effect.

The second paper (No. IV), metabolism studies with pigeons fed polished rice with and without added yeast, reports a further study of the effect of a polished rice diet with and without yeast on the metabolism of pigeons. The results obtained confirm those of a previous study (E. S. R., 44, p. 559), in that loss of body weight, a lowering of temperature, and a decreased gas metabolism occurred during the polished rice régime, followed by increase in weight, a rise in body temperature, and increased metabolism on the addition of yeast to the diet. The author is of the opinion that the vitamin contained in the yeast has a special influence on the physical state of the cell contents, possibly due to its chemical structure.

As reported in the third paper (No. V), on feeding pigeons polished rice with varying amounts of yeast, it was found that 0.05 gm. of dried yeast was insufficient to protect against polyneuritis, the birds dying in from 30 to 70 days. With 0.1 gm. of yeast some of the birds maintained their body weight, while others gradually lost weight. With 0.2 gm. there was a gain in body weight,

and with 0.5 gm. the birds rapidly regained all the weight lost on the vitamin-free diet. Parallel with the gain in weight there was a rise in temperature to normal, thus showing that the yeast had a favorable effect on the total tissue metabolism.

The physiological effect of undernutrition, G. LUSK (*Physiol. Rev.*, 1 (1921), No. 4, pp. 523-552).—The special phases considered in this review of the effects of undernutrition are protein metabolism, loss of body protein, retention of protein, energy metabolism, the effect of emaciation upon the energy metabolism, the effects of a normal diet after undernutrition, the production of mechanical work during undernutrition, anatomical and chemical changes within the body, the influence of external cold, the heart and circulation, the influence of sex, war edema, metabolism of atrophic children, xerophthalmia, undernutrition and the incidence of disease, and the prevention of famine.

Studies on experimental rickets.—III, A pathological condition bearing fundamental resemblances to rickets of the human being resulting from diets low in phosphorus and fat-soluble A: The phosphate ion in its prevention, P. G. SHIPLEY, E. A. PARK, E. V. MCCOLLUM, and N. SIMMONDS (*Bul. Johns Hopkins Hosp.*, 32 (1921), No. 363, pp. 160-166, pls. 3, fig. 1).—In continuation of the series of studies on experimental rickets previously noted (E. S. R., 45, p. 368), evidence is presented that the phosphate ion in the diet may be a determining influence for or against the development of rickets, as has previously been pointed out by Sherman and Pappenheimer (E. S. R., 45, p. 767).

Diets characterized by a deficiency in vitamin A and phosphorus produced in the experimental rats xerophthalmia and changes in the skeleton showing the fundamental characteristics of rickets to a greater or less degree. Diets deficient in vitamin A but containing adequate phosphorus produced xerophthalmia and a pathological bone condition which bore no resemblance to rickets, but showed rather the typical picture of osteoporosis.

"Since the addition of the phosphate ion to the diet prevented the development of the rickets-like changes in the skeleton, but had no effect in preventing xerophthalmia, it seems permissible to infer that xerophthalmia and rickets do not have an identical etiology. The above results do not in our opinion exclude the fat-soluble A from consideration as an etiological factor in the production of rickets and kindred diseases, since the level of the blood phosphate is, in all probability, determined in part by the amount of the fat-soluble A available for the needs of the organism."

Studies on experimental rickets, IV, V (Soc. Expt. Biol. and Med. Proc., 18 (1921), No. 8, pp. 275-280).—In continuation of the studies on rickets two papers are presented.

IV. Cod liver oil as contrasted with butter fat in the protection against the effects of insufficient calcium in the diet, E. V. McCollum, N. Simmonds, P. G. Shipley, and E. A. Park (pp. 275-277).—This is a brief note on the differences observed in the effectiveness of cod liver oil as compared with butter in a diet low in calcium, but with an optimum amount of phosphorus. Such a basal diet is the following: Wheat 30, maize 19.5, rice (polished) 9.5, rolled oats 8.5, peas 8.5, navy beans 8.5, steak 10, NaCl 1, NaHCO₃ 1.5, and cod liver oil 3 per cent. The calcium content of this food mixture (excluding cod liver oil) is calculated as 0.059 gm. per 100 gm., and the phosphorus 0.3546 gm. This food mixture with butter fat to the extent of 3, 10, or 20 per cent of the food mixture failed to induce an appreciable amount of growth, but with 3 per cent of butter and 1.5 per cent of calcium carbonate proved a very satisfactory diet for maintenance, growth, and reproduction. On the basal diet with the addition of 10 per cent of casein, but with no butter or cod liver oil, pathological changes characteristic of

rickets were produced, while with small amounts of cod liver oil (3 per cent) no rachitic changes could be observed in the bones.

"The striking differences between the nutritive properties of cod liver oil as contrasted with butter fat we have up to the present time been able to demonstrate in so satisfactory a manner only with diets in which the phosphorus content is approximately the optimum, and with the calcium content distinctly below the optimum."

V. *The production of rickets by means of a diet faulty in only two respects*, P. G. Shipley, E. A. Park, E. V. McCollum, and N. Simmonds (pp. 277-280).—The authors report that rickets and xerophthalmia are produced in a comparatively short time on the following diet: Rolled oats 40, gelatin 10, wheat gluten 7, sodium chlorid 1, potassium chlorid 1, calcium carbonate 2, and dextrin 39 per cent. This diet is extremely poor in vitamin A and relatively low in phosphorus, but contains an abundant supply of proteins of good quality and an optimum content of calcium. When butter fat was added in the proportion of 0.5 per cent of the total ration the occurrence of xerophthalmia was somewhat postponed, but the pathological bone conditions were unmodified. When 10 per cent of the butter fat was added, xerophthalmia was entirely prevented and the pathological condition, while still rickets, was not so intense. The addition of 2 per cent of cod liver oil completely prevented all changes of a pathological nature. When calcium carbonate was replaced by calcium hydrogen phosphate, the pathological condition which developed in the skeleton was not rickets but osteoporosis.

The authors conclude that a deficiency in the organic antirachitic factor, combined with low phosphorus and optimal calcium, gives rise to rickets, which can be prevented by raising only the level of the phosphorus. If both calcium and phosphorus are low, a condition of osteoporosis but not rickets develops. It is further emphasized that butter is feeble and cod liver oil powerful in antirachitic properties.

Studies on experimental rickets, VI, VII (*Amer. Jour. Hyg.*, 1 (1921), No. 4, pp. 492-525, pls. 9, figs. 10).—In continuation of the above study two papers are presented.

VI. *The effects on growing rats of diets deficient in calcium*, E. V. McCollum, N. Simmonds, P. G. Shipley, and E. A. Park (pp. 492-511).—In this paper the authors describe at length the effects on growth and the changes in the skeleton which result from restricting the intake of calcium, the diet being in all other respects suitably constituted. On several such diets rats developed a pathological condition of the bone which bore certain fundamental resemblances to human rickets, but differed from it in that the arrangement of the proliferative zone of cartilage cells was maintained and that the evidences of bone resorption in the diaphysis were excessive. The rickets-like condition did not develop if the deficiency in calcium was compensated for by the addition to the diet of calcium carbonate nor if cod liver oil was administered. An amount of butter fat which was amply sufficient to protect the animals against keratomalacia did not protect the animals against the development of rickets-like lesions.

VII. *The relative effectiveness of cod liver oil as contrasted with butter fat for protecting the body against insufficient calcium in the presence of a normal phosphorus supply*, P. G. Shipley, E. A. Park, E. V. McCollum, and N. Simmonds (pp. 512-525).—This is essentially an amplification of the fourth paper of the series. In conclusion the authors suggest the possibility that "a dietary essentially distinct from the antiophthalmic substance (fat-soluble A) may exist, If this is the case this would appear to be present in butter fat in small amounts, but to be very abundant in cod liver oil.

"When the amount of calcium in the diet is below the optimum, but the phosphorus is normal, the rôle of the antirachitic substance is to direct as far as possible the bone development in the direction of normal. When the calcium and phosphorus content of the diet, and presumably the other mineral elements, are nearly optimal, the amount of antirachitic substance needed by the body is small, and its function appears to be regulatory. The need for this substance is greatly increased when there is partial starvation for calcium."

Studies on experimental rickets.—VIII, **The production of rickets by diets low in phosphorus and fat-soluble A**, E. V. MCCOLLUM, N. SIMMONDS, P. G. SHIPLEY, and E. A. PARK (*Jour. Biol. Chem.*, 47 (1921), No. 3, pp. 507-527, pls. 4).—This paper is essentially an amplification of the fifth paper in the series, as noted above. In discussing their experimental results, the authors call attention to the paper by Sherman and Pappenheimer (*E. S. R.*, 45, p. 767) in which was first noted the possibility of the prevention of rickets in rats by the simple substitution of a small amount of potassium phosphate for the calcium lactate of the rickets-producing diet. In interpreting these results it is suggested, as has also been brought out by Sherman and Pappenheimer in the detailed report of their investigation (*E. S. R.*, 46, p. 165), that the rachitic condition may be due to a disproportion in the calcium-phosphate ration.

The effect of various modifications of a diet producing rickets in rats, A. M. PAPPENHEIMER, G. F. MCCANN, T. F. ZUCKER, and A. F. HESS (*Soc. Expt. Biol. and Med. Proc.* 18 (1921), No. 8, pp. 267-270).—A brief report is given of a continuation of the experiments reported by Sherman and Pappenheimer (*E. S. R.*, 46, p. 165) in which the protective action against rickets of small amounts of basic potassium phosphate was demonstrated. The observations recorded in the previous paper have been confirmed in tests on a further series of rats, and in addition the effect has been determined of various additions to the basal rickets-producing diets.

It has been found that the protection is conferred by the phosphate and not by the potassium ion. The minimal amount of phosphate calculated as (P) which, when added to a basal diet furnishing 87 mg. per 100 gm., was found to lie between 50 and 25 mg. The effects of further additions to the basic diets may be summarized as follows:

The addition of 0.2 gm. of pasteurized butter daily prevented the occurrence of ophthalmia, but did not prevent the development of rickets in the four animals tested. The addition of 60 mg. of "Harris yeast vitamin" daily to the basal diet gave complete protection against rickets in three rats, all of which, however, showed ophthalmia. The phosphorus content of this preparation came within the range which in the form of an equivalent amount of phosphate would confer protection from rickets. The addition of 10 gm. of purified casein to 100 gm. of the basal diet gave results which were difficult to interpret, as all three rats of this series showed, in X-rays taken after 22 days on the diet, distinct rachitic lesions which were markedly less on the thirty-eighth day. Complete protection was afforded by the addition of both casein and yeast.

The radiographic evidence of the influence of cod liver oil in rickets, E. A. PARK and J. HOWLAND (*Bul. Johns Hopkins Hosp.*, 32 (1921), No. 369, pp. 341-344, pls. 4).—From radiographic evidence in some 50 cases of rickets, the authors have become convinced that cod liver oil is a specific for rickets. The change in the bones resulting from the administration of the oil is not noticeable at once, but is readily demonstrable in about a month. In two or three months so much infiltration with salts has taken place that the extremities of the bones, except for deformities, are practically normal.

The blood and blood vessels in guinea pig scurvy, G. M. FINDLAY (*Jour. Path. and Bact.*, 24 (1921), No. 4, pp. 446-453).—In the present investigation particular attention has been paid to the changes in the blood and vascular systems in guinea pigs rendered scorbutic by an ad libitum diet of oats and bran, with the addition of 60 cc. of autoclaved milk per diem. Twenty-four animals varying in weight from 250 to 400 gm. were given this ration, while 6 serving as controls received in addition 5 cc. of orange juice daily. Of the animals receiving the scorbutic diet 12 were killed at intervals of 48 hours beginning with the second day of the experiment, while 12 were allowed to develop well marked clinical symptoms of scurvy. Six of these were killed before and 6 during the terminal semicomatose stage.

Red cell counts made simultaneously on blood obtained from the small vessels at the margin of the ear and directly from the heart of animals with definite chemical symptoms of scurvy showed a much greater reduction in the numbers in the heart blood than in the capillaries. This is thought to indicate that in the later stages of guinea pig scurvy there occurs a stagnation in the capillaries which would result in insufficient oxygenation of the tissues.

Examination of the vascular system showed dilation of the heart in 8 out of 12 animals dying from scurvy, the dilation being on the right side alone in all but 2 cases. Hypertrophy of the heart muscle was not encountered. Microscopically the muscle fiber showed loss of striation, but there was never any fatty degeneration. The interstitial connective tissue appeared edematous in places, the capillaries were congested, and in 5 cases there was definite hemorrhagic infiltration of the heart wall. The larger arteries and veins showed no abnormality, but the capillaries and smaller veins showed definite pathological changes consisting of degenerative changes in the lining endothelium, extreme congestion, fine edema of the tissues surrounding the vessels, and hemorrhagic areas in close relation to the capillaries.

The earliest signs of hemorrhage were found microscopically in a guinea pig killed after 12 days on the scorbutic diet, the hemorrhages occurring in minute areas in the muscles at the back of both knee-joints. By the fourteenth day the hemorrhages became visible to the naked eye at the knee-joints, in the axillae, and at the costochondral junctions. Hemorrhagic foci were most common in the kidney, bladder, intestine, liver, adrenal, bone marrow, and spleen in increasing order; were rare in the lungs, thyroid, pancreas, and pituitary; and were never seen in the central nervous system of the adult, nor in the thymus, lymphatic glands, testicle, and ovary.

The author concludes that the essential lesion in scurvy is the interference with the nutrition of the capillary endothelium, resulting in stagnation of the blood in the capillaries, followed by insufficient oxygenation and death. The occurrence of hemorrhage is considered merely incidental to the wearing out of the intracellular substance.

A note on experimental scurvy in the rabbit, and on the effects of antenatal nutrition, G. M. FINDLAY (*Jour. Path. and Bact.*, 24 (1921), No. 4, pp. 454, 455, pl. 1).—Attempts to induce scurvy in 6 adult rabbits by feeding them oats, bran, and water are reported. On this ration the rabbits gradually lost weight but developed no external signs of scurvy. Three which were continued on this diet died after 31, 41, and 63 days, respectively. The post-mortem examination of these animals showed extreme congestion in the internal organs but no hemorrhages. Two rabbits which were still alive at the end of 63 days, but had lost 37.3 and 35.4 per cent of their body weight, respectively, were then given 10 cc. of swede juice per day in addition to the oats-bran diet, with a resulting rapid gain in weight and improvement in general condition.

Two of the female rabbits which became pregnant during the course of the experiment gave birth, one to 3 and the other to 4 young. All of these were born dead and showed typical congestion of the knee-joints with signs of hemorrhage into the tissues surrounding the joints.

The author concludes that the nonsusceptibility of the rabbit to scurvy must be looked upon as relative rather than absolute.

Further experiments on the preservation of lemon juice and prevention of scurvy, P. W. BASSETT-SMITH (*Lancet [London]*, 1921, II, No. 7, pp. 321, 322, figs. 2).—A further test of the stability of the antiscorbutic vitamin in the lemon juice tablets previously described (E. S. R., 45, p. 167) is reported. Similar tablets were found to retain their antiscorbutic properties after storage for over 12 months at room temperature. Commercial lemon juice prepared from the whole fruit at Messina and specially protected from heat was found to have lost all its antiscorbutic properties when tested on its arrival in England. A second sample of lemon juice preserved with sodium metabisulphite gave equally poor results, thus confirming the work of Davey (E. S. R., 45, p. 869).

The author also reports that the juice from commercially canned tomatoes was effective in 4-cc. doses both as a prophylactic and a curative agent in guinea pig scurvy.

Chemical factors in fatigue.—I, The effect of muscular exercise upon certain common blood constituents, N. W. RAKESTRAW (*Jour. Biol. Chem.*, 47 (1921), No 3, pp. 565-591).—An investigation conducted on 21 human subjects is reported of the change produced in several constituents of the blood by severe muscular exercise of two types—a short strenuous effort of running up and down two flights of stairs until exhausted, and the more prolonged but less violent exercise of bicycle riding at considerable speed.

The first form of exercise invariably increased the blood sugar concentration in both the plasma and corpuscles, while the longer period of exercise was accompanied by a drop in blood sugar greater in the plasma than in the whole blood. Both kinds of exercise were accompanied by a small increase in uric acid, greater in the plasma than in the whole blood, and a slight increase in total creatinin, but no change in preformed creatinin. Short strenuous exercise had no effect upon urea or nonprotein nitrogen, but longer work increased both slightly, in whole blood as well as plasma. There were no considerable changes in the total blood volume during the muscular exercise. The specific gravity, hemoglobin, and the number and relative volume of corpuscles increased during the periods of exercise, and the viscosity of the whole blood increased considerably and that of the plasma slightly.

"Incomplete data are given suggesting that the total nitrogen is increased in the blood by exercise and that urea, nonprotein nitrogen, and uric acid continue to increase for some time after a work period, while the sugar concentration, on the other hand, returns to normal within two and one-half hours."

ANIMAL PRODUCTION.

[Work in animal husbandry] (*Kansas Sta. Rpt. 1920*, pp. 26-28, 30-32).—The results of an experiment on the feeding value of alfalfa hay cut at different stages of growth showed that the rate of gain by the calves fed and the feed efficiency of the hay declined as the cutting was deferred. The gains ranged from 0.46 lb. per day by calves fed hay cut at the seed stage to 1.07 lbs. for those fed hay cut at the bud stage. The coefficients of digestibility of the four kinds of hay used are reported.

In swine nutrition studies results secured with rats agreed with those obtained with the first generation of swine and indicated in general that both

corn and tankage and kafir and tankage are inadequate, and that the addition of alfalfa to the ration of kafir and tankage makes the diet adequate for both growth and reproduction.

Results thus far secured in a study of factors influencing the composition of body fats indicated that the unsaturated fatty acids of the feed are deposited in the body fat, while the short-chained fatty acids are not, and that the body fat produced by a high protein diet differs from that produced by a low protein diet.

The nutritive value of cattle feeds.—II, Oat by-products for farm stock, J. B. LINDSEY and C. L. BEALS (*Massachusetts Sta. Bul. 200 (1920), pp. 117-135; pop. ed., pp. 10, figs. 2*).—This bulletin, the second of a series on the nutritive value of cattle feeds (*E. S. R., 44, p. 670*), presents the results of an investigation of the composition and digestibility of oat by-products and of the feeding value of oat feed, a mixture of approximately 80 per cent of oat hulls and 20 per cent of middlings and dust constituting the residue from oat meal mills. The analytical results, together with those secured in digestion experiments with sheep, horses, and dairy cows, are given in tables.

The results indicated that an average quality of oat feed contains 5 to 6 per cent of protein, about 2 per cent of fat, and not over 27 per cent of fiber. In the digestion experiments the digestibility of oat feed fell a little below that of hay, but the feeding trials with dairy cows showed it to be slightly superior in the production of milk. Feeding 5 to 6 lbs. daily of oat feed in place of a like amount of hay to horses gave quite satisfactory results, and the addition of 1 lb. of cottonseed meal daily in the grain mixture seemed to have a favorable effect. It is concluded that from 6 to 8 lbs. of oat feed well moistened may be fed daily to mature cattle, proportionately less to young stock, and about 5 to 6 lbs. daily to horses.

[Inheritance in Orthoptera and in guinea pigs] (*Kansas Sta. Rpt. 1920, pp. 39, 40*).—A brief report of progress is presented, and the work of the past year is noted.

Varied matings are reported as resulting in several new linkages in the genus *Apotettix*. As many as four different characters were linked into a single individual so as to breed true. It is stated that these linkages occur on a definite percentage basis and can be predicted as certainly as Mendelian segregation.

Studies with guinea pigs did not disclose positive evidence that defects such as congenital blindness, absence of toes, and certain other characters are inherited. Two new inbred generations of guinea pigs did not show any decrease in vigor, fecundity, or size.

Cattle feeding.—XVII, Winter steer feeding, 1920-21, J. H. SKINNER and F. G. KING (*Indiana Sta. Bul. 255 (1921), pp. 24; pop. ed., pp. 8*).—The feeding experiments here reported were undertaken in continuation of work previously noted (*E. S. R., 43, p. 869*), to determine the value of the quantity of corn and of a protein supplement in the ration for fattening steers when they are fed with corn silage or corn-soy bean silage. Of seven lots of 10 steers each, in a feeding trial lasting 130 days, lots 1, 2, 3, and 4 received a basal ration of corn silage, clover hay, and cottonseed meal. Lot 1 was given in addition, during the last 50 days of the trial a full feed of corn, lot 2 received no corn, lot 3 a half feed of corn during the entire period, and lot 4 a full feed of corn during the entire period. Lot 5 was fed like lot 4, excepting that it received corn-soy bean silage instead of corn silage. Lot 6 received corn-soy bean silage, and lot 7 corn silage, their rations being the same as those of lots 5 and 4, respectively, with the exception that no cottonseed meal was fed. The principal results of the experiment are summarized in the table following.

Summary of results of a steer feeding experiment, December 16, 1920, to April 25, 1921.

Lots.	Average daily feed per steer.				Average daily gain.	Cost of gain per 100 pounds.	Pork produced.
	Shelled corn.	Cotton seed meal.	Silage.	Clover hay.			
	Pounds.	Pounds.	Pounds.	Pounds.	Pounds.		Pounds.
1.....	4.78	2.44	39.70	2.12	2.66	\$6.75	345
2.....		2.44	46.00	2.54	2.28	6.70	212
3.....	5.65	2.44	36.83	2.08	2.35	7.73	435
4.....	11.25	2.44	31.65	1.32	2.72	7.93	585
5.....	11.23	2.44	31.01	1.40	2.71	7.94	605
6.....	11.39		31.95	1.74	2.31	7.70	589
7.....	11.33		31.06	1.73	2.27	7.76	625

The cost of gain per 100 lbs. is based on the following prices: Corn 50 cts. per bushel, cottonseed meal \$35 per ton, clover hay \$14 per ton, and silage \$4 per ton. The rations including a full feed of corn as compared with those without corn or with only a half feed produced the more rapid and more economical gains. Owing to market conditions none of the lots gave profitable results. The gains of hogs were in proportion to the grain fed. The use of cottonseed meal showed an increase in rate and also in cost of gain, but produced an increase in the value of the finished cattle sufficient to make it profitable.

Dressing and cutting beef on the farm, M. D. HELSER (*Iowa Sta. Circ. 72 (1921), pp. 23, figs. 29*).—Detailed directions are given for the selection of beef for killing, the killing and dressing operations, and the cutting of the beef carcass, with suggestions as to the care and use of the offal and trimmings.

Dressing and cutting lamb and mutton on the farm, M. D. HELSER (*Iowa Sta. Circ. 71 (1921), pp. 16, figs. 24*).—The operations of killing, dressing, and cutting lamb and mutton are described in detail, with suggestions as to the tools required, the logical order of procedure, and the use of certain parts of the carcass and their preparation.

Sheep feeding.—X, Fattening western lambs, 1919–20 and 1920–21, J. H. SKINNER and C. M. VESTAL (*Indiana Sta. Bul. 256 (1921), pp. 16, fig. 1; pop. ed., pp. 8, fig. 1*).—In continuation of previous work (E. S. R., 43, p. 375), two feeding trials with eight lots of 25 lambs each were conducted from October to January, ending in 1920 and 1921, respectively. The ration consisted of shelled corn 4 or 7 parts to 1 part of cottonseed meal or linseed meal with corn silage and clover hay or oat straw. The lambs were fed twice daily. After the grain had been eaten silage was fed in amounts that would be cleaned up in about an hour and then clover hay or oat straw was given to last up to the next feeding time. The lambs were started on whole oats, gradually replaced by the other concentrates during a period of 2 weeks, and the grain was gradually increased to full feed at the end of 3½ weeks. One lot otherwise fed 1 part of cottonseed meal to 7 parts corn received 0.25 lb. of cottonseed meal per head per day for the first 40 days when no corn was fed, and another lot receiving the limited feeding of shelled corn with silage and clover hay received the same quantity of cottonseed meal as the lot before mentioned.

In each feeding test the lot fed shelled corn 7 parts and cottonseed meal 1 part with corn silage and clover hay gave the most profitable returns. All lots receiving a full feed of concentrates were in marketable condition at the close of 100 days in the first and of 80 days in the second experiment, but the two lots receiving limited amounts of corn as indicated above were not fat enough for market at that time. The lambs fed clover hay made more rapid gains, con-

sumed less feed to produce their gains, were valued higher at the finish, and were more profitable than the lambs fed oat straw. In a similar manner cottonseed meal as compared with linseed meal proved slightly the higher in feeding value, and liberal amounts of these protein concentrates in three out of four trials gave better results than those secured with restricted amounts.

The Angora goat, G. P. WILLIAMS (*U. S. Dept. Agr., Farmers' Bul. 1203 (1921), pp. 26, figs. 12*).—The history of the Angora goat is reviewed, the distribution in the United States is outlined, the present type of the breed is described, and the management of goats on the range is discussed in detail. The grading of mohair is described, and the different qualities or characteristics of the product are defined. Notes are given on the diseases and insects affecting goats.

[Feeding trials with fattening pigs], G. A. BROWN (*Michigan Sta. Rpt. 1920, pp. 230, 231*).—The results of three feeding trials to determine the relative efficiency of corn, barley, and rye, alone and in combination, with digester tankage as a protein supplement, concluded during the year, are summarized in a table without comment. The highest average gain per pig, 1.56 lbs., was secured with corn and tankage, and the next highest with corn, rye, barley, and tankage. The ration of rye, middlings, and tankage ranked first in the lowest quantity of feed per pound of gain with 4.57 lbs., being followed by corn and tankage with 4.77 lbs., but it stood last in average daily gain per pig.

[Work in the poultry department] (*Kansas Sta. Rpt. 1920, pp. 34, 35*).—A comparison of common grains as the sole source of feed for day-old chicks showed that wheat gave slightly better results in connection with weight than those obtained from corn, kafir, or oats. The use of cabbage gave fairly good results as a vitamin source, ranking in this regard above carrots. The feeding of tomatoes failed to prevent leg weakness. The use of commercial chick feeds made up partly of weed seeds was found undesirable. The vitamin content of eggs was shown to be dependent on the vitamin content of the feeds fed the hens.

Final report of the second western Washington egg-laying contest, Mr. and Mrs. G. R. SHOUP (*Washington Sta., West. Wash. Sta. Bimo. Bul., 9 (1922), No. 6, pp. 89-95*).—The winning pen of five White Leghorns is reported as making the high record of laying 1,384 eggs during the year. Of the 79 entries in the contest, 7 pens laid each over 1,300 eggs and 21 pens each over 1,200 eggs. The performance of the different pens of 5 birds each is reported in a table.

DAIRY FARMING—DAIRYING.

[Work in dairy husbandry] (*Kansas Sta. Rpt. 1920, pp. 30, 31*).—A brief report is given covering work on Sudan grass as a pasture for dairy cows noted from another source (*E. S. R., 43, p. 176*). In feeding silage to dairy cattle, whole kafir and whole cane silage gave slightly better returns than were secured from the use of kafir stover silage and of cane stover silage. Of the two kinds of stover silage, that made from cane stover gave slightly the better results. Feeding cattle with silage made from wild sunflowers proved unsatisfactory. Feeding ground cane seed to five dairy cows during three 30-day periods did not depress milk production or produce other unfavorable effects.

The milk cows fed continuously on a practically vitamin-free ration consisting of pearl hominy, tankage, cottonseed meal, and wet beet pulp was much lower in fat-soluble and water-soluble vitamins than the milk from cows fed ordinary

rations. A similar difference regarding antiscorbutic vitamins was not observed.

The colorimetric hydrogen-ion determination as a means of studying biological changes in dairy products, L. H. COOLEIDGE (*Michigan Sta. Tech. Bul.* 52 (1921), pp. 20, figs. 4).—This bulletin calls attention to the possibilities of applying the pH method, previously reported and described (E. S. R., 43, p. 615), for the determination of biological changes in market milk and other dairy products. The technique for determining the keeping quality of milk by the method and the apparatus devised at the station for its simplification are described and the results of experimental work in judging the keeping quality of milk by means of this and other methods are presented. A plan of grading milk and of paying a bonus for milk with unusual keeping quality is outlined.

The tabulated results indicates how the score of milks tested by the pH method compares with the bacterial count and with the actual keeping quality as judged by tasting after storing the milk for 24 hours at 21°C. A rearranged summary of the results shows that the average bacterial count checks up quite closely with the score based upon rate of change in H-ion concentration. It is pointed out that there are many individual cases in which a high bacterial count did not indicate poor keeping quality nor a low bacterial count always good keeping quality. It is not claimed that the pH method checks closely with the bacterial count, but only that the results show that it checks in a general way, and that it checks very well with the actual keeping quality of the milk.

A comparison of the actual keeping quality of 115 samples of milk with results obtained by applying the reductase test, the pH test, and the bacterial count gave results very much in favor of the pH test.

The microscopic study of bacteria in cheese, G. J. HUCKER (*New York State Sta. Tech. Bul.* 87 (1921), pp. 3-11, pl. 1).—Previously noted from another source (E. S. R., 46, p. 177).

VETERINARY MEDICINE.

Army veterinary service in war, J. MOORE (*London: H. & W. Brown, 1921, pp. [11]+191, pls. 16, figs. 2*).—In the first part of this work, the author, who is director of veterinary services in India and late director of veterinary services, British Expeditionary Force, in France, 1914-1919, deals with the organization and function of the army veterinary service in the war. The parts following deal, respectively, with the wastage of animals in war, army veterinary service as an instructional agency, the merits and demerits of the various breeds of animals used in war, economy to be effected in the disposal of animals wasted by war, and extracts from official dispatches.

Report on the operations of the veterinary sanitary service of Paris and the Department of the Seine during the year 1920, H. MARTEL (*Serv. Vét. Sanit. Paris et Dépt. Seine, Rap. Opér., 1920, pp. 187, figs. 4*).—This is the usual annual report (E. S. R., 45, p. 478), covering the work of the year 1920 and including much statistical data.

Report on the veterinary service of Saxony for 1919 (*Ber. Veterinärw. Freistaat Sachsen, 64 (1919), pp. V+209*).—This is the usual annual report dealing with the occurrence of diseases of domestic animals, meat inspection work, etc.

Annual report of the Bengal Veterinary College and of the Civil Veterinary Department, Bengal, for the year 1920-21, A. SMITH and P. J. KER (*Bengal Vet. Col. and Civ. Vet. Dept. Ann. Rpt. 1920-21, pp. 4+II+7+IX+2*).—This is the usual annual report (E. S. R., 45, p. 382).

Annual report of the Civil Veterinary Department, Bihar and Orissa, for the year 1920-21, P. B. RILEY (*Bihar and Orissa Civ. Vet. Dept. Ann. Rpt., 1920-21, pp. [3]+8+XIV+2, pl. 1*).—This is the usual annual report (E. S. R., 45, p. 177).

Annual administration report of the Bombay Veterinary College and Civil Veterinary Department in the Bombay Presidency (including Sind), 1920-21, G. TAYLOR, J. L. RIEU, and J. H. G. JERROM (*Bombay Vet. Col. and Civ. Vet. Dept. Ann. Admin. Rpt., 1920-21, pp. 41+2*).—This is the usual annual report (E. S. R., 45, p. 382).

Laws relating to the department of animal industry ([*Lansing: Mich. Dept. Anim. Indus.*], 1920, pp. 38).—This is a compilation of the Michigan statutes relating to the subject.

Disinfecting skins and hair for anthrax, H. F. SMYTH (*Amer. Jour. Hyg.*, 1 (1921), No. 5-6, pp. 541-556).—The author's studies have led to the following summary and conclusions:

"In these tests five strains of anthrax bacilli were employed, an old laboratory stock strain, three strains isolated from tannery soak vats, and one strain isolated from horse hair. Especially resistant spores were obtained by preliminary growth on wheat agar. Rejuvenation of spores damaged by treatment, but not killed, was encouraged by subculture in dextrose-serum bouillon. In testing action on skins the most satisfactory method of preparing test samples was found to be the intradermal inoculation of soaked squares of skin with saline suspensions of anthrax spores. The lime soak of 5 per cent of CaO permitted by the Bureau of Animal Industry regulations proved to be unreliable, even after a 72-hour exposure.

"The Schattenfroh method of soaking skins in 2 per cent HCl and 10 per cent NaCl solution for 48 hours at room temperature gave uniformly good results if carried out under conditions similar to those employed in the tannery, and produced skins that could be made into satisfactory leather. Anthrax infested horse hair can be satisfactorily disinfected by several methods: (1) By steam under pressure in the autoclave (15 lbs.) for 30 minutes, (2) by dry heat—200° F. for 24 hours (but not 200° for 15 minutes as permitted by the Bureau of Animal Industry), and (3) by formaldehyde as used in England. Cyllin disinfectant in the strength and under the conditions certified in England will not kill anthrax spores."

A bibliography of 15 literature references is appended.

Some characteristics of *Bacillus chauvæi*, L. W. GOSS, R. E. BARBARIN, and A. W. HAINES (*Jour. Infect. Diseases*, 29 (1921), No. 6, pp. 615-629, figs. 3).—This paper deals with the morphological and cultural characteristics of *B. chauvæi* as determined by a study of 15 strains of the organism—14 isolated from field cases of blackleg in Kansas, Michigan, and Iowa, and 1 from infected muscle received from the Bureau of Animal Industry, U. S. D. A.; the isolation of *B. chauvæi* from infected muscle; its pathogenicity for various species of animals; and the value of various immunological tests as means of identification of the organism.

The failure of pure cultures of *B. chauvæi* to grow on 2 per cent glucose agar is considered to be the most important criterion for judging the purity of the culture. To isolate the organism from infected muscle, a small piece of the material is macerated in sterile salt solution and a few cubic centimeters of the suspension drawn into a capillary pipette and heated at 60° C. for 45 minutes. Heated and unheated portions of the suspension are seeded on liver agar, 2 per cent glucose agar, and Hibler medium in varying dilutions. A guinea pig is injected subcutaneously with 1 cc. of each suspension. After incubation at 37°

for from 18 to 24 hours characteristic colonies from the liver agar tubes are planted again in liver agar, glucose agar, and Hibler medium. This is repeated until the purity is assured by morphologic study, failure to grow in 2 per cent glucose agar, animal inoculations, and protection tests. If the inoculated guinea pig dies in less than 16 hours, death is probably due to a more invasive organism than *B. chauvæi* such as *Vibrio septique*, but by immunizing the guinea pigs against *V. septique* and not *B. chauvæi* death usually results from blackleg and the organism may be isolated in this way.

The guinea pig is considered the animal of choice in the experimental study of *B. chauvæi*. Cultures which have a high virulence for guinea pigs are fatal to mice, although much higher doses are required to kill the latter. Pigeons are also much less susceptible to blackleg than guinea pigs. Sheep are apparently somewhat refractory to natural infection but can be infected with large doses of virulent cultures of *B. chauvæi*. Kids may be fatally infected with pure cultures of *B. chauvæi*.

Protection tests with antiblackleg serum indicate a marked specificity for *B. chauvæi*. It is also possible that the agglutination reaction may be of use in the identification of this organism.

The toxin of blackleg and toxic endocarditis, E. RAVENNA (*Clin. Vet., Rass. Polizia Sanit. e Ig. [Milan]*, 44 (1921), No. 9-10, pp. 237-256, pl. 1).—In this paper evidence is presented that the bacillus of blackleg elaborates in broth culture exotoxins which are filterable through a Berkfeld filter, and that these toxins on intravenous injection into guinea pigs are capable of producing a typical toxic endocarditis. This is thought to account for the endocarditis observed in cattle afflicted with blackleg.

The serum simultaneous method of inoculation against rinderpest, W. A. POOL (*Agr. Research Inst. Pusa Bul. 120* (1921), pp. 7).—This publication consists of detailed directions for the serum simultaneous method of inoculation against rinderpest, applicable to conditions in India. A table is given of the recommended doses of serum in cubic centimeters per 600 lbs. body weight for cattle of different breeds, the amounts varying from 30 cc. for cattle of the native Haryana breed to from 250 to 300 cc. for purebred Ayrshire cattle. One cc. of virulent blood is used for cattle of country breeds and $\frac{1}{2}$ cc. for purebred and crossbred.

Attention is called to the possible danger of piroplasmosis as a complication of the rinderpest reaction. It is advised that as a method of prevention temperature charts for each virus producer should be maintained and the blood smears from each animal examined daily from the time the temperature reaction begins until the blood is used. If the animal proves to be infected with piroplasmosis its blood should not be employed. Blood smears should also be made of any inoculated animal showing high temperature, and any animal showing piroplasmosis should be given an intravenous injection of 20 cc. of a saturated solution of Trypan blue in 0.8 per cent salt solution per 100 lbs. of body weight.

It is stated that in the course of 5,000 inoculations of animals carried out under the direction of this laboratory in all parts of India, the total mortality has been under 0.8 per cent.

Suggested model time tables are given for inoculating a herd when virus producers have to be inoculated and when the virulent rinderpest blood can be obtained in bulk.

Serum prophylaxis and serum therapy for tetanus (with directions for its practical application to horses), P. C. BARDELLI (*Clin. Vet., Rass. Polizia Sanit. e Ig. [Milan]*, 44 (1921), No 8, pp. 205-220).—A general discussion.

Fixation reaction (the Besredka antigen) and tuberculosis, J. RIEUX and BASS (*Ann. Inst. Pasteur*, 35 (1921), No. 6, pp. 378-387).—Complement fixation tests with the Besredka antigen, conducted on the sera of 425 patients with tuberculosis in varying degree and with no signs of tuberculosis, are reported and discussed.

The author concludes that the reaction is specific for tuberculosis, with the exceptions that positive results may be given by syphilitic sera and the sera of persons afflicted with malaria, and that negative results may be given in tuberculosis of very recent origin and in certain rapidly developing types of tuberculosis. Compared with other methods of diagnosis, it is considered intermediate between the tuberculin reaction and the direct test for tubercle bacilli—less harmful and more specific than the former, and more prompt than, and as specific as, the latter.

The intradermal tuberculin test with supplementary notes, E. R. DERFLINGER (*Vet. Alumni Quart. [Ohio State Univ.]*, 9 (1921), No. 1, pp. 12-15).—Practical directions are given for the application and interpretation of the intradermal tuberculin test.

Recording tuberculin tests, with reference to the intradermal and ophthalmic tests, M. H. REYNOLDS (*Jour. Amer. Vet. Med. Assoc.*, 59 (1921), No. 2, pp. 191-197, fig. 1).—A list of abbreviations and symbols for use in recording tuberculin tests is given, with an accompanying illustrative chart of an actual record made with the use of these symbols.

The rôle of the bovine type of tubercle bacillus in human tuberculosis, C. KRUMWIEDE (*Internatl. Assoc. Dairy and Milk Insp. Ann. Rpt.*, 8 (1919), pp. 167-175).—This paper, presented at the eighth annual meeting of the International Association of Dairy and Milk Inspectors at New York City in December, 1919, is based upon investigations conducted by the New York Department of Health. An earlier account by Park and Krumwiede has been noted (E. S. R., 27, p. 885).

The struggle against bovine tuberculosis in the United States: Accredited herds, L. PANISSET (*Rev. Gén. Méd. Vét.*, 30 (1921), No. 357, pp. 505-513).—This is a description of the accredited-herd plan of the Bureau of Animal Industry, U. S. D. A.

Tuberculosis of equines and its importance in tuberculosis eradication by the accredited-herd plan, F. BOERNER, JR. (*Jour. Amer. Vet. Med. Assoc.*, 59 (1921), No. 2, pp. 184-190, figs. 3).—A brief summary is given of four cases of bovine tuberculosis in horses which had been pastured with cattle. The possibility is pointed out of such animals becoming dangerous spreaders of the disease, and it is recommended that exposed horses be subjected to the tuberculin test.

The diseases of the genital organs of domestic animals, W. L. WILLIAMS (*Ithaca, N. Y.: Author*, 1921, pp. XVIII+856, pls. 8, figs. 243).—The several chapters of this work, which was compiled with the collaboration of W. W. Williams, deal, respectively, with (1) diseases and defects of the genital organs not attributed to infection (pp. 1-238); (2) tumors of the genital organs (pp. 239-277); and (3) infections of the genital organs (pp. 278-839).

Further studies on the pathology of the reproductive organs in sterility, E. T. HALIMAN (*Michigan Sta. Rpt.* 1920, pp. 288-303).—This is a report of studies of cases from four herds of cattle in which abortion had been a more or less serious problem for six to eight years, conducted in collaboration with the department of bacteriology. Of the 11 cases reported upon, all except two were clinically sterile, while one was slaughtered because of a periuterine abscess and another because of abortion about seven weeks before. The results have been summarized by the author in part as follows:

"The anatomical alterations of the uterine mucosa vary in the different animals from slight fibrous thickening of the transverse cervical folds with no apparent alterations of the corporal and cornual mucosae to an atrophic endometritis. The lesions observed in varying degrees in the different cases are mucoid degeneration of the superficial epithelium, local and diffuse fibrosis of the uterine mucosae, leucocytic infiltration of the stroma and gland luminae and degeneration and disintegration of the glandular epithelium with diminution in the number of glands.

"In the majority of cases the anatomical alterations are comparatively few, and it is hardly conceivable that failure to breed was the result of loss of functional tissue of the uterine mucosae. Of course, it is not known to what extent the uterine mucosa may be anatomically altered and yet remain functional, but it may be logically assumed that considerable alterations are necessary to render the uterus permanently sterile. Surely some fibrosis of the mucosae with some loss of uterine glands should not render the uterus functionally inactive. This is not nature's way. Theoretically, before arriving at a conclusion—and conclusions can not be drawn until more data are available—we must distinguish between the sequelae of an active condition and the effects of a condition still active. Judging from alterations of other functional organs considerable of the former are compatible with functional activity. This thought suggests two problems of research that are vital to the solution of the cause of sterility, viz, the alterations of the secretions and their effect on the male and female sexual cells because of an active morbid condition of the uterine mucosae and, second, the effects of such a condition on the cyclic functional activity of the ovary."

Morphological and physiological studies on the musculature of the mature Graafian follicle of the sow, M. S. and A. F. GUTTMACHER (*Bul. Johns Hopkins Hosp.*, 32 (1921), No. 370, pp. 394-399, pl. 1, figs. 4).—"The theca externa of the Graafian follicle of the sow contains an abundance of typical smooth muscle cells. Autonomic nerves with typical motor endings are found in juxtaposition to these muscle cells. The musculature of the ovary and its follicles has a double innervation, the true sympathetics acting as inhibitory and the parasympathetics as excitatory nerves. This innervation is similar to that of the musculature of the intestine. The rupture of the follicle is not produced solely by an increase in the arterial tension of the follicular vessels."

Researches regarding epizootic abortion of cattle, J. MFADYEAN (*Jour. Compar. Path. and Ther.*, 34 (1921), Nos. 2, pp. 105-126; 3, pp. 191-211).—This continuation of investigations previously noted (*E. S. R.*, 45, p. 583) gives the details of studies made of seven additional herds.

Bovine abortion and its control, J. T. EDWARDS (*Vet. Rec., n. ser.*, 1 (1921), Nos. 37, pp. 721-734; 38, pp. 739-748).—This paper consists of an extensive and critical review of the literature on contagious abortion in cattle.

Results from immunizing cattle against abortion, F. B. HADLEY (*Jour. Amer. Vet. Med. Assoc.*, 60 (1921), No. 1, pp. 26-33, fig. 1).—The results are reported of vaccinating cattle against abortion in Wisconsin during 1919 and 1920 with vaccine prepared from living abortion bacilli by the method previously described (*E. S. R.*, 43, p. 82). A total of 474 cows and heifers was vaccinated, of which 439 were available for data, the rest having failed to breed, having been sold, or died. Only 14.1 per cent of the vaccinated animals aborted, while of the 101 controls 31.2 per cent aborted. Of 127 unbred heifers vaccinated previous to conception, 77.9 per cent calved normally and of the controls only 66.7 per cent. With open cows that had never aborted, the vaccination

was effective in 91.8 per cent in contrast to 44.4 per cent in the controls. The vaccine had little value when administered to open cows that had aborted, or that had never aborted but were pregnant at the time of vaccination. Bacterins prepared from abortion bacilli were found to have no immunizing value.

These results are compared with similar data reported from Germany and England. The live abortion bacilli proved 93.5 per cent active in preventing abortion in England and 94.2 per cent active in Germany as compared with 85.9 per cent in the Wisconsin data. In England 23.4 per cent of the control animals aborted, in Germany 18.1 per cent, and in Wisconsin 31.2 per cent. The author attributes these differences in results largely to the probable difference in virulence of the infection in various places.

Bovine piroplasmiasis, H. FRASER (*Vet. Rec., n. ser., 1* (1921), No. 48, pp. 939-942).—This is an account of the disease as it occurs in Great Britain, where it is transmitted by *Ixodes ricinus* and *Haemophysalis punctata*, and its treatment. In practice the author has found the intravenous injection of tartar emetic, 15 grains dissolved in 2 oz. of sterile water and repeated in 18 to 24 hours when necessary, to be most successful.

Trypanosomes and trypanosomiasis of cattle, H. E. HORNBY (*Jour. Compar. Path. and Ther., 34* (1921), No. 3, pp. 211-240, fig. 1).—This consists of summaries and accounts of the diseases caused by six species of pathogenic Trypanosoma, namely, *T. congolense* Brod., *T. vivax* Zie., *T. uniforme* Bruce *T. evansi* Steel, *T. gambiense* Dut., and *T. brucei* P. & B. A bibliography of five pages is included.

A study of the literature concerning poisoning of cattle by the prussic acid in sorghum, Sudan grass, and Johnson grass, H. N. VINALL (*Jour. Amer. Soc. Agron., 13* (1921), No. 6-7, pp. 267-280).—This is a review of the present status of knowledge of the subject, based upon the literature, with a list of 22 references.

[Abortion in sheep], I. F. HUDDLESON (*Michigan Sta. Rpt. 1920*, pp. 252, 253).—An epizootic of abortion in sheep at a farm near Union City, Mich., is reported which was apparently due to an organism other than the *Bacterium abortus* of bovine abortion. Cultures made from the stomach contents of the fetus and the uterine exudate of a guinea pig which had aborted following inoculation with the uterine exudate from an aborting ewe showed the presence of an oval micrococcus 0.8 to 1 micron in diameter, occurring singly or in chains of 2, 3, or 4. The organism was nonspore- and noncapsule-forming, Gram-positive, and grew aerobically on dextrose broth and as fine colonies on slants of liver agar. In dextrose broth uniform cloudiness was produced by the organism in 24 hours, with slight sedimentation at the end of 3 days, but with no pellicle formation. In dextrose, maltose, sucrose, and lactose media, acid but no gas formation resulted. A further study is to be made of this organism.

Contagious pustulous stomatitis in sheep, M. AYNAUD (*Compt. Rend. Acad. Sci. [Paris], 173* (1921), No. 20, pp. 950-952).—A method of vaccinating lambs against contagious pustulous stomatitis is described as follows: A year-old lamb is inoculated cutaneously on the under side of the leg with secretions from the buccal ulcerations of a diseased animal. Vesicles form on the inoculated spot about the third day. These become purulent at about the sixth day and after from 8 to 12 days form dried scabs. These scabs are ground up in a mortar with glycerin and serve as the vaccine for inoculating the lambs in the same manner.

No general reaction is said to follow the inoculation, and the immunity acquired through the vaccination is said to last for at least 9 months.

On the etiology of epizootic meningo-encephalitis (Borna disease) of equines, R. KRAUS, L. KANTOR, H. FISCHER, and R. QUIROGA (*Ztschr. Immunitätsf. u. Expt. Ther.*, I, Orig., 30 (1920), No. 2, pp. 121-143, figs. 9; abs. in *Trop. Vet. Bul.*, 9 (1921), No. 3, pp. 174-176).—Previously noted from another source (*E. S. R.*, 44, p. 280).

Dourine in Canada, 1904-1920, E. A. WATSON (*Ottawa: Canada Dept. Agr., Health Anim. Branch*, 1920, pp. 43, pls. 14).—Following a brief introduction, a review and summary are given of the history, investigation, and suppression of dourine (pp. 5-9), which includes statistics of the number of horses destroyed (a total of 1,933) from 1904 to 1920, their value, and the compensation paid. The natural disease is next considered (pp. 10-14). Then follow six appendixes dealing with the subject as follows: Diagnosis (pp. 15, 16), dourine and the complement fixation test (pp. 16-35), experimental dourine (pp. 35-38), *Trypanosoma equiperdum* (pp. 39, 40), regulations relating to *maladie du coit* (pp. 40, 41), and dourine references (pp. 41-43).

Experiments on the active immunization of horses against glanders, SCHÜTZ and O. WALDEMANN (*Arch. Wiss. u. Prakt. Tierheilk.*, 46 (1920), No. 3-4, pp. 172-185).—Attempts at the active immunization of horses against glanders by the use of heat-killed bacilli are reported. These were on the whole unsuccessful, although one of the four horses treated with glanders bacilli killed by dry heat proved resistant to the subsequent subcutaneous injection of virulent glanders bacilli. The animals treated with the heat-killed bacilli gave the same mallein reaction as those suffering from the disease.

Strongylid parasites of horses in the Punjab, C. L. BOULENGER (*Parasitology*, 13 (1921), No. 4, pp. 315-326, figs. 5).—Notes are presented on 21 species observed by the author, which compose the majority of the species of common occurrence in the Punjab. A list of 30 references to the literature is appended.

Experiments to determine the value of chicken-pox vaccine, F. BOERNER, JR., and E. L. STUBBS (*Jour. Amer. Vet. Med. Assoc.*, 60 (1921), No. 1, pp. 83-91).—This paper reports the results of tests conducted by the Pennsylvania Bureau of Animal Industry to determine the value of chicken-pox vaccine prepared as described by Beach (*E. S. R.*, 44, p. 782). Badly infected flocks at four different farms were vaccinated with vaccines prepared from the scabs of diseased birds. In each case some pens were left as controls. In all cases no greater improvement was shown in the vaccinated than in the control birds. It is pointed out that if all the birds had been vaccinated the conclusion might be drawn that the treatment was beneficial, but the similarity in improvement of vaccinated and nonvaccinated indicates that the vaccine is of no practical value in controlling chicken pox.

[Studies on roup] (*Kansas Sta. Rpt.* 1920, p. 38).—It is reported that a bacterial vaccine for roup and fowl typhoid has been developed. When tested on a total of 225 birds in 12 flocks only 4 developed the disease after treatment as compared with 117 which acquired the disease before the vaccine was given.

Further work on the relation between adequacy of diet and immunity to roup has confirmed the conclusions previously drawn (*E. S. R.*, 44, p. 281) that a diet lacking in vitamins tends to lower the vitality of chickens and increase their susceptibility to roup.

Further observations on blackhead in turkeys, E. E. TYZZER, M. FABYAN, and N. C. FOOT (*Jour. Infect. Diseases*, 29 (1921), No. 3, pp. 268-286).—This is a report of investigations conducted during the summer of 1920 in continuation of those previously noted (*E. S. R.*, 43, p. 885).

It was determined that the causative organism as found in turkey liver lesions survives for at least 4 days at 5° C., deteriorates more rapidly at 22°, and is immediately destroyed by freezing. As compared with subcutaneous inoculation, intravenous inoculation results much less frequently in infection. The results show that immunity is not produced by negative intravenous inoculation. However, it was found impossible to infect a turkey that had recovered from inoculated blackhead.

"The treatment of the turkey by repeated subcutaneous injections of emetin hydrochlorid in doses sufficiently large to produce toxic symptoms fails to prevent the development of subcutaneous blackhead, even though commenced immediately after inoculation. Of two cases thus treated, one recovered; but spontaneous recovery from blackhead occasionally occurs. Repeated injections of Niagara blue and India ink (whether before or after inoculation) do not apparently alter the course of the disease."

Attempts to produce blackhead by the intestinal route show that the disease is not caused by the mere feeding of infected tissues. Apparently ripe *Heterakis* ova may fail to develop when fed to young turkeys kept in a clean chamber and furnished with sterilized food and water, but they readily develop in those having access to the soil. While blackhead appears to develop quite constantly as the result of feeding ripe *Heterakis* ova, the study of a large number of turkeys indicates that the disease may occur when this worm is rare or entirely absent from the ceca.

"It is also apparent that young turkeys do not develop blackhead as readily from the slow acquisition of *Heterakis* ova as they do from large overwhelming doses, such as those given experimentally. These findings suggest that the invasion of the tissue by *Histomonas* in spontaneous blackhead is not dependent solely on the presence of *Heterakis*, but on pathologic conditions that may occur not only in association with this parasite worm but also quite independent of it.

"A self-limited infection, similar to that produced in young chickens and pigeons, follows the inoculation of blackhead into young pheasants and guinea chicks. All of these species show a much more extensive tissue reaction to the virus than that which occurs in the more susceptible turkey. Both the European sparrow and Indian Runner duck appear to be nonsusceptible. The turkey embryo is apparently unsuitable as a medium for the development of *Histomonas*, for incubated turkey eggs were inoculated with blackhead virus without result. Blackhead has followed the exposure of a young turkey to common fowls, confirming the experience of the previous years and emphasizing the importance of isolation in rearing turkeys."

RURAL ENGINEERING.

Practical structural design, E. McCULLOUGH (*New York: U. P. C. Book Co., Inc., 1921, 2. ed., rev. and enl., pp. 317, figs. 198*).—This is a reference work for engineers, architects, and builders. It contains chapters on external forces, internal forces, problems in design of beams, girders and trusses, joints and connections, graphic statics, columns and structures, and semirigid frames.

Cost keeping and construction accounting, G. E. Ross (*Salem, Oreg.: Ross System Co., 1919, 2. ed., pp. 171, pls. 3, figs. 13*).—This is the second edition of this book, which deals with cost keeping and accounting for engineering organizations. It contains chapters on cost accounting, essentials of cost systems, the account number book—its general use, the account number book—features and items, automobiles and trucks, binders and forms for field and office,

and general information regarding the account number book and forms illustrated.

Annual report of the Reclamation Service, 1919-20, E. F. DRAKE (*Canada Dept. Int., Reclam. Serv. Ann. Rpt., 1919-20, pp. 80, pls. 2, figs. 2*).—This is the annual report of the director of the Reclamation Service of the Department of the Interior of Canada, and includes the report of the commissioner of irrigation.

The irrigation work in Canada during the year seems to have comprised numerous different lines of activity, including hydrometric surveys, investigations of irrigation projects, and duty of water investigations. The report of the chief engineer of the drainage division is also presented. Work of that division included the investigation of several projects in Manitoba, Saskatchewan, and Alberta.

Report of the select committee on irrigation projects, H. MENTZ (*Union So. Africa, Select Com. Irrig. Projects Rpt., 1920, pp. XIV+127*).—The proceedings of a select committee appointed to investigate certain irrigation projects in the Union of South Africa are presented in detail.

Irrigation in India, review for 1919-20 (*India Pub. Works Dept., Irrig. India, 1919-20, pp. [3]+21+26, pls. 11*).—This is the second supplementary report on the work, expenditures and revenues, and irrigation operations in India as a whole and in the various provinces during the year 1919-20.

Administration report on the Irrigation Branch for the year 1918-19 (*Cent. Provs. and Berar [India], Irrig. Branch Admin. Rpt., 1918-19, pp. [2]+62*).—This report covers the activities, expenses, and revenues of the Irrigation Branch of the Public Works Department of the Central Provinces and Berar of India for the fiscal year 1918-19.

[Administration report of the Irrigation Branch of the Northwest Frontier Province, India] (*Northwest Frontier Prov., Irrig. Branch Admin. Rpt., 1919-20, pp. 24+19+19+XXI, pls. 13*).—This report includes statistical statements and accounts relating to irrigation, water distribution, and working of distributaries for the Irrigation Branch of the Public Works Department of the Northwest Frontier Province of India for the year 1919-20, together with statistics of revenues and expenditures up to the year 1919-20.

The saving of irrigation water in wheat growing, A. and G. L. C. HOWARD (*Agr. Research Inst. Pusa Bul. 118 (1921), pp. [3]+22, pl. 1, fig. 1*).—This report has been previously noted from another source (*E. S. R., 42, p. 480*).

Drainage law supplement (*Minn. State Dept. Drainage and Waters, Drainage Law Sup., 1921, pp. 41*).—This pamphlet contains the text of the Minnesota drainage laws and amendments thereto affecting drainage and flood control; enacted by the legislature of 1921.

The clays and shales of Virginia west of the Blue Ridge, H. RIES and R. E. SOMERS (*Va. Geol. Survey Bul. 20 (1920), pp. IX+118, pls. 13, figs. 8*).—This report outlines the distribution of the clay and shale-bearing formations within the Appalachian Mountains province of Virginia together with their possible uses. The results indicate that the Appalachian Mountains province of Virginia contains a greater variety of plastic material than either the Piedmont or Coastal Plain provinces, and that it includes clay suitable for common and pressed brick, drain-tile, hollow blocks, fire brick, etc.

Practical use of excess sand in concrete mixtures, R. W. CRUM (*Engin. News-Rec., 87 (1921), No. 20, pp. 812-814, figs. 7*).—A summary is given of a large number of tests of Iowa pit-run gravels to determine practical methods of using the excess sand therein for concrete pavements.

It was found that in about 35.5 miles of concrete road, in which unscreened pit-run gravel was used as aggregate, as good concrete was obtained as where screened aggregate was used. It is concluded that pavements may be designed from concretes using pit-run gravel or high ratios of sand to coarse aggregate and be equivalent to pavements made from common arbitrary mixtures such as 1:2:3½, provided the same standards of supervision and inspection are maintained.

Studies on cooling of fresh concrete in freezing weather, T. YOSHIDA (*Ill. Univ. Engin. Expt. Sta. Bul. 123 (1921), pp. 63, figs. 19*).—Studies on the length of time required for concrete of a given temperature to lose its heat and become cold enough to freeze when it is exposed to temperatures lower than the freezing point of water are reported, which included the determination of the values of diffusivity and the ratio of emissivity to the coefficient of thermal conductivity for freshly placed concrete. Some experiments were also made on the protective effect of coverings, and a number of applications of the experimental data are presented.

From the experiments on cooling of fresh concrete and rise in temperature during setting of concrete and mortar, the conclusion is drawn that "(1) for the application of the mathematical theory of heat conduction to the cooling of fresh concrete, the thermal constants, diffusivity and the ratio of the emissivity to the coefficient of conductivity, for commonly used concrete mixtures having the wettest consistency which can satisfactorily be used in cold weather and a still air condition, may be taken, in C. G. S. units, as 0.0063 and 0.046, respectively. These figures are specially safe for massive concrete work and for rich concretes. (2) Under favorable temperature conditions in the concrete the rise in temperature during its setting is greatest in the period between 6 and 12 hours after the time of mixing. It is important that as much strength as possible be acquired at an early age if the concrete is later to be subjected to low temperatures. It is, therefore, important and necessary in cold weather to protect concrete very carefully for at least 12 hours after pouring, because during that time the chemical action of cement and water is greatest, the increase in strength is very marked, the heat produced helps to retard the later cooling of the concrete, and protection during this period makes the concrete better able to resist the effect of low temperature. (3) It is apparent from the analysis that very much more care must be taken to prevent the freezing of the concrete in relatively light structures than in massive work. (4) Wind has very great effect on the cooling of fresh concrete. Every precaution should be taken to protect the surface from the wind."

Cooling curves are given for massive concrete, thin walls and slabs, and beams and columns, from which the time of cooling and the temperature attained by the concrete in any particular case may be estimated. The protection afforded by board forms and by canvas was found to be considerable. If a canvas protection is used, care must be taken to prevent any circulation of cold air, and it is best to observe the temperature in the air space by means of a thermometer. Knowing this temperature, the time when the freezing temperature will penetrate into the concrete may be estimated from the diagrams and the necessity of using artificial heat determined. The heating of the materials is concluded to furnish an excellent method of insuring early hardening and delaying the fall in temperature. It is much to be preferred to the use of chemicals.

Central-plant-mixed concrete tested for maximum safe haul (*U. S. Dept. Agr., Public Roads, 4 (1921), No. 8, pp. 22, 23, fig. 1*).—Studies made to determine the probable safe maximum length of haul for central-plant-mixed con-

crete to be used in road construction are reported. A concrete of 1:1.5:3 mix was used.

It was found that the strength was not affected so long as the concrete was workable. The appearance of the concrete during the experiment indicated that it could have been handled by a concrete pavement finishing machine at any period up to two hours after mixing. It became too dry for hand finishing, however, 45 minutes after mixing.

Report of the State Roads Commission of Maryland (*Md. State Roads Comm. Ann. Rpts. 9-12 (1916-1919)*, pp. 67+[9], pls. 24).—This report deals with the activities and expenditures of the Maryland State Roads Commission for the period from December 31, 1915, to December 31, 1919.

Public Roads (*U. S. Dept. Agr., Public Roads, 4 (1921)*, No. 8, pp. 25, figs. 85).—This number of this periodical contains the usual project statements under Federal-aid allowances approved in October, 1921, together with the status of Federal aid as of October 31, and the following articles:

The Motor Truck Impact Tests of the Bureau of Public Roads, by E. B. Smith (see below); The Federal Highway Act; Central-Plant-Mixed Concrete Tested for Maximum Safe Haul (see p. 488); and Interesting Facts about Forest Roads.

The motor truck impact tests of the Bureau of Public Roads, E. B. SMITH (*U. S. Dept. Agr., Public Roads, 4 (1921)*, No. 8, pp. 1-16, 23, figs. 83).—In a continuation of these studies (*E. S. R.*, 45, p. 82), investigations are reported to compare solid rubber tires, cushion tires, and cushion wheels.

It was found that the static deformation of tires is a possible measure of their cushioning value. The best cushioning effect and the least impact force developed were observed when using a new cushion tire 36 by 5 in., with a total depth of 4½ in. and having a complete annular opening in the center of the tire. This tire when tested under different static loads showed almost uniform deflection in proportion to the loading and a somewhat greater deflection than a pneumatic tire under the same static loading. Compared for cushioning effect under impact forces, other conditions being constant, the pneumatic tire was found to be much the better of the two.

It was observed in these tests that the deflection of different tires under different static loads was a fairly reliable indication of their cushioning effect under impact forces only when the tires compared were of the same type. The deflection of pneumatic tires was found to be practically directly proportional to the load applied, and the resistance to deflection is not dependent upon the material of the tire but mainly upon the air within. The cushioning properties of the pneumatic tire remained in proportion to the load and still functioned at the end of the blow.

In tests of cushion wheels, three different makes were used, two of them being very similar in construction. Their main feature was a corrugated rubber cushion interposed between the base rim on the outside of the wheel and an inner rim. An ordinary solid rubber tire was mounted on this wheel, the idea being to furnish an additional cushion between the felloe at the end of the spokes and the rim of the solid rubber tire. One of these wheels was so constructed that there were six solid soft rubber cushions carried in the supporting rims in place of the ordinary spokes. This wheel seemed to be very much more flexible than the other two.

The average results of a comparison of tires and cushion wheels on a large 7.5-ton truck, carrying full load, showed very little or practically no advantage of the cushion wheel over the ordinary solid wheel carrying the same tire. In fact the cushioning shown against impact was not as good as that shown by the dual solid tire equipment on the regular solid wheel.

These results are taken to indicate that there is no particular advantage in the cushion wheel. The wheels tested did not seem to offer cushioning that is of any practical advantage over the single solid tire equipment on the ordinary rigid wheel. The cushion wheel constructed with six rubber cushions showed considerably more advantage than the other type of cushion wheel.

The flash and burning points of gasoline-kerosene mixtures, J. T. ROBSON and J. R. WITHROW (*Amer. Inst. Chem. Engin. Trans.*, 12 (1919), pt. 1, pp. 129-155, figs. 7; also in *Ohio State Univ. Engin. Expt. Sta. Bul.* 18 (1921), pp. 129-155, figs. 7).—Studies are reported to determine the amount of gasoline necessary to make modern kerosene dangerous and to cause its flash point to fall below the legal limit of 120° F. for the State of Ohio.

The results indicate that both the flash and burning points of kerosene are greatly reduced by the smallest admixtures of the more volatile petroleum fractions such as gasoline, so that grave danger can easily result therefrom. It was found that the early records of the influence of light petroleum distillates upon burning oils were based upon fractions radically different in properties from similarly named products of modern refining. The main original need for State flash point laws has ceased. Nevertheless, public safety still requires their enforcement.

The Foster closed cup flash determination permits the presence of much lighter petroleum distillates than the Cleveland open cup method. The gasoline and other light petroleum fractions were found to be miscible instantaneously with kerosene if intimately mixed. It is concluded that stratification in large tanks is merely due to insufficient mixing or lack of time for diffusion.

While ordinary kerosene of commerce extinguishes a burning match, the addition of gasoline to the extent of 1 per cent may give a flash. Three to 5 per cent may give violent flashing and 7.5 per cent may inflame at once. Any of these would give explosions if confined.

The relation is established between flash and burning point and percentage of volatile petroleum fractions admixed with kerosene. Working conditions are given minutely to establish the comparative dependability of the final values for future cases of comparison. Distillation and gravity characteristics of the fractions used are also recorded.

Stress coefficients for large horizontal pipes, J. M. PARIS (*Engin. News-Rec.*, 87 (1921), No. 19, pp. 768-771, figs. 23).—This is an intricate mathematical analysis in which various elementary kinds of loading on horizontal pipes are separately considered and adapted by proper combination to actual loadings under any condition of support and surcharge.

Results of some tests of manila rope, A. H. STANG and L. R. STRICKENBERG (*U. S. Dept. Com., Bur. Standards Technol. Paper* 198 (1921), pp. 11, pls. 2, figs. 3).—The results of tensile tests of 368 specimens of 3-strand, regular lay manila rope, having diameters of from 0.5 to 4.5 in., are summarized in this circular.

The average breaking load was found to be approximately a quadratic function of the diameter of the rope. It is expressed quite closely by the equation $L = cd(d+1)$, in which L is the load in pounds, c is a constant equal to 5,000, and d is the diameter of the rope in inches. The ropes showed a continually varying modulus of elasticity and no well-defined proportional limit. The number of yarns composing a rope may be expressed approximately by the equation $N = kd(d+0.4)$, where N is the number of yarns, k is a constant equal to 50, and d is the diameter of the rope in inches. The test results cover sufficient range and show such consistency that it is believed that the formulas deduced may be used safely for 3-strand, regular lay manila rope for sizes of rope between 0.5 and 4.5 in. in diameter.

Procedure for establishing a list of permissible electric motors, H. F. BAIN (*U. S. Dept. Int., Bur. Mines Sched. 2B (1921), pp. 11*).—This publication states the fees, character of tests, and conditions under which tests and inspections of motors and their electrical accessories will be made by the U. S. Bureau of Mines.

National physical laboratory traction dynamometer for agricultural tractors, J. H. HYDE (*Engineering [London], 110 (1920), No. 2865, pp. 693, 694, figs. 7; also in Agr. Jour. India, 16 (1921), No. 4, pp. 417-423, figs. 7*).—A dynamometer designed to measure the traction or drawbar pull of the tractors tested at the Lincoln trials in England is described and diagrammatically illustrated. It consists of a cylinder and plunger, the former being attached to the drawbar of the tractor and the latter through links to the plow. The pull on the coupling sets up a pressure in the oil confined in the cylinder, and this pressure is transmitted to a recording pressure gauge by a flexible hydraulic tube.

The connection to the tractor drawbar is made in such a manner that the cylinder can not rotate, but the opposite end of the dynamometer is provided with a swivel attachment for the plow.

The recording instrument is mounted on a 2-wheeled carriage which is towed by the tractor, a suitable hitch being made to prevent damage to the connecting hydraulic tube.

Farm fencing, A. C. KIMREY, W. W. SHAY, G. EVANS, and B. F. KAUPP (*N. C. Agr. Col. Ext. Circ. 118 (1921), pp. 32, figs. 28*).—Popular information is given on the selection of posts, wires, gates, and other accessories, and on the construction of farm fences. A number of diagrammatic illustrations showing methods of construction are included.

The modern packing house, D. I. DAVIS (*Chicago: Nickerson & Collins Co., 1921, 2. ed., rev. and enl., pp. XVI+472, figs. 172*).—This is a new, revised, amplified, and enlarged edition of this book, the first edition of which was prepared by F. W. Wilder. It is a complete treatise on the design, construction, equipment, and operation of meat packing houses according to present American practice, including methods of converting by-products into commercial articles. It contains chapters on modern packing houses; location and construction; plant design; refrigeration equipment; refrigeration requirements; power plant requirement; coolers; warehouses; slaughtering cattle; dressing yields and cattle cutting; hides and pelts; oleo oil and stearin; bone department; tank house department; tank water; fertilizer; casings; beef miscellany; sheep and calves; hog slaughtering; pork cuttings; curing meats; lard, compound, and greases; smoke house; domestic sausage; dried sausage; butterine; boxes and cooperage; and departmental accounting.

Artificial heat for animal shelters, K. J. T. EKBLAW (*Agr. Engin., 2 (1921), No. 1, pp. 13-17, figs. 4*).—The results of a study of the design of artificial heating systems for animal shelters, including hog houses and cattle and dairy barns, are presented in this report. The author is of the opinion that the artificial heating of both hog houses and dairy barns is justified in severe climates, and gives the details of design of a typical system for each type of shelter, using the Mills rule for the amount of steam radiation required.

The design of outtake flues for stable ventilation, J. L. STRAHAN (*Agr. Engin., 2 (1921), No. 10, pp. 207-209, fig. 1*).—In a contribution from the Massachusetts Agricultural College, a mathematical discussion of the design of outtake flues for stable ventilation is presented.

Sanitary disposal of sewage through a septic tank, H. R. CROHURST (*Pub. Health Rpts. [U. S.], 35 (1920), No. 50, pp. 2959-2964, figs. 2*).—The material

in this article has been obtained from reports of studies by others and from the results of an inspection of systems in operation in New Hampshire.

The design of the septic tank recommended consists of a rectangular tank built of concrete without baffles, with a relatively tight-fitting cover and without ventilation. A space of from 12 to 15 in. is provided between the under side of the cover and the surface of the sewage. The cover is made to fit as tightly as possible, in order that the gas given off during the septic action may develop a slight pressure in the dead space above the sewage and serve to exclude outside air. The inlet and outlet pipes of the tank are provided with elbows which turn downward into the sewage and end well below the surface. Experience in New Hampshire has shown that a capacity of 4 cu. ft. (30 gal.) should be allowed for each person contributing to the tank. The smallest tank recommended is 6 ft. long, 3.5 ft. wide, and has a depth of sewage of 4.5 ft.

Final disposal by absorption or by filter trenches, according to the physical properties of the soil, is recommended. Working drawings of tanks and disposal systems are included.

Nonbacterial population of sewage trickling filters, C. R. Fox (*Engin. News-Rec.*, 87 (1921), No. 18, pp. 720-725).—A review of literature and observations of the growth on the surface of two small and one large institutional trickling filters, treating fresh Imhoff tank effluents, are presented, indicating that vegetable growths are more harmful than helpful and that animal growths are harmless or beneficial.

Vegetable growths are likely to cause pooling trouble on such filters, which far outweighs any benefits derived from biochemical changes induced by them. The dissolved oxygen and nitrate contents of the applied sewage are considered to be probably the controlling factors in determining the character of the growths in the filters.

It was found that objectionable life in filters may be prevented or killed by the use of chemicals, flooding, or resting the beds. The use of chemicals is expensive and would require special supervision to be economically feasible. Flooding is usually not possible because of the open structure of trickling filters. The resting of clogged filter beds is concluded to be the most successful way in which to restore them to normal conditions.

The desirability of being able to rest portions of the filter area is taken to indicate that all trickling filters should be constructed with several independent units. It is stated, however, that the amount of reserve area required can not be intelligently proportioned without advance knowledge as to the character of the growths to be anticipated.

RURAL ECONOMICS AND SOCIOLOGY.

Open types of public markets, MCF. KERBEY (*U. S. Dept. Agr. Bul.* 1002 (1921), pp. 18, figs. 4).—The term "market" as used in this study applies to a place and a group of conditions which furnish facilities for sales to a group of independent, wholesale or retail dealers. A properly operated public market is said to make possible the free interaction of the forces of supply and demand and, by placing the operation of these forces under the observation of the producer, furnishes an opportunity for arrival at a fair market price. Open public markets of various kinds may be owned or controlled by municipalities, organizations of producers, or commercial corporations. Numerous suggestions are made with regard to the factors in successful operation of producers' markets, the final and one of the most crucial of which is said to be that the direct operation should be entrusted to a capable and experienced manager. A topical out-

line is drawn up for a survey to determine whether or not local conditions may be favorable. Other suggestions are offered as to choice of site, kinds of structures which may be used for shelter, and methods of financing.

Farming costs, C. S. ORWIN (*Oxford, Eng.: Clarendon Press, 1921, new ed., rewritten, pp. 141, figs. 5*).—This is a new edition of a study previously noted (*E. S. R.*, 40, p. 192), rewritten and somewhat replanned. New problems and illustrations have been introduced. An extensive classified bibliography (pp. 116-137) is included.

Cooperation in farm accounting, H. M. ELIOT and F. T. RIDDELL (*East Lansing: Mich. Agr. Col., 1920, pp. 18, figs. 13*).—Under a cooperative plan entered into by the Michigan State Grange, the Michigan State Agricultural College, and the U. S. Department of Agriculture, 1,075 account books were distributed to farmers in the State. This preliminary report, on the basis of records kept in them, shows yields and income from each crop, the enterprise or special costs on each, and records for dairy cattle. The seasonal labor distribution on these crops and on dairy cattle is illustrated in a series of charts.

Labor and material requirements of field crops, L. A. MOORHOUSE and O. A. JUVE (*U. S. Dept. Agr. Bul. 1000 (1921), pp. 56, figs. 16*).—This is a summary of all the available crop requirement data assembled by the Office of Farm Management and Farm Economics based upon enterprise survey records which have been obtained during the past 10 years and on a large number of detailed farm accounting records which have been assembled in cooperation with several agricultural experiment stations. Acre requirements of labor and materials are tabulated and presented graphically for certain staple crops including corn, corn silage, cotton, potatoes, sugar beets, tobacco, beans, grain sorghums, spring and winter wheat, oats, barley, rye, hay, grass seed crops, apples, and miscellaneous crops. The labor distribution is given by 10-day periods, except in the graph for sugar beets, in which case it is shown by months. In connection with each table certain significant differences in the quantity requirements shown for the respective districts are pointed out, and, in some cases, field practices are briefly discussed. It is intended that these data furnish a basis for the calculation of production costs.

Farm development studies in northern Minnesota, C. G. WORSHAM and A. BOSS (*Minnesota Sta. Bul. 196 (1921), pp. 5-47, figs. 3*).—A survey previously noted (*E. S. R.*, 44, p. 787) is reported in detail, and conclusions are drawn as to the comparative rapidity of farm development on the prairie lands of Mahanomen County and in the cut-over districts of the Blackduck and Grand Rapids sections in Beltrami and Itasca Counties, respectively. The usual settlement practices followed are described. Summaries of the year's business in 1918 in each of these sections are made comparing such items as farm value; value of machinery, live stock, and hay and feed; income from forest products sold; interest charge; value of unpaid family labor; and the labor income of the settler.

Report of committee on rural credits, 1920, W. T. JACKMAN, T. McMILLAN, and M. H. STAPLES (*Ontario Dept. Agr., Com. Rural Credits Rpt., 1920, pp. 45*).—In its report on the credit system deemed suitable to agricultural needs in the Province of Ontario, this committee of the Ontario Department of Agriculture proposes the organization of a land mortgage bank to act in conjunction with rural credit societies, having a capital stock of \$500,000 subscribed and taken by farmers and payable in installments of about 25 per cent. Applications for long loans are to be passed upon in the same way as those for the short loans by the directors of the rural credit societies, and their approval is to be handed on to the land mortgage bank in Toronto.

Certain features of this land bank project are discussed in detail, such as the amount of capital stock, the limitation of dividends, reserve fund, taxation of land bank bonds, incorporation under provincial statutes, and selection of directors.

Considerable information relating to land mortgage and short term credit facilities in foreign countries and in other Provinces in Canada has been compiled and presented as introductory to the report on the plan outlined.

A short bibliography on rural credits is appended.

Iowa's farm credit plan, L. A. ANDREW (*Iowa Agr.*, 22 (1921), No. 7, pp. 181, 182, figs. 2).—This is a brief article on the organization and purposes of a permanent corporation of Iowa farmers and business men established to make short and long term loans direct to farmers or through banks.

Agricola: A study of agriculture and rustic life in the Greco-Roman world from the point of view of labor, W. E. HEITLAND (*Cambridge, Eng.: Univ. Press*, 1921, pp. X+492).—This volume embodies the results of a detailed inquiry into evidence in classical literature bearing upon labor conditions in agriculture in ancient Greece and Rome. The writings of a long list of authors are searched, one by one, for references to the attitude of the age toward agriculture and pastoral pursuits, farm life, slavery, and related topics.

The agricultural laborer in the early nineteenth century, J. L. HAMMOND (*Jour. Min. Agr. [London]*, 28 (1921), No. 7, pp. 586-597).—England and France are cited as examples of the dissolution of the old village society under the influence in the one case of aristocratic and in the other of revolutionary ideas. When the medieval village system was dissolved by the revolution in France, the peasant came into possession of a certain amount of the land; while in England the agrarian revolution, beginning at the close of the sixteenth century and continuing through the eighteenth and part of the nineteenth, dispossessed villagers, and the land remained in the hands of aristocracy that lived on the land, took an important part in the local government, and believed in the application of capital to farming, the tilling of the soil to be performed by the proletariat.

The effect of inclosures; the degradation of English life by doles from the rates; the Poor Law of 1834; the roundsman system, by which the parish distributed unemployed laborers among the parishioners, the parish paying two-thirds of their wages and the employer one-third; the game laws and the importance of poaching in the maintenance of the poor; and various schemes for improvement of the conditions of labor in England are briefly noted.

The livelihood of agricultural laborers in Japan, S. NAKAMURA (*Jour. Polit. Econ.*, 29 (1921), No. 9, pp. 767-771).—Some official statistics setting forth the area of arable land and the total number of farming families are reviewed. Tables are included which are the result of the author's investigation of the family budget of an agricultural laborer's family, showing a considerable deficit. It is noted also that reports of the agricultural society of Japan indicate that in 32 per cent of the cases of farmers running into debt the cause lies in their relatively high living expenses.

Report of the New South Wales Board of Trade upon the rural industries and the question of a rural living wage, G. S. BEEBY ET AL. (*Sydney: Govt.*, 1921, pp. 47).—Since July 5, 1920, when a separate public inquiry into the cost of living of employees engaged in rural occupations was reinstituted, continuing a similar one carried on in the preceding year, 51 witnesses have been examined. Official statistics have also been employed. Findings and evidential matter submitted during this investigation are published here, with brief tabulations of index numbers and detailed reports which are included in ap-

pendixes. Declaration by the board as to wages has been postponed, anticipating still further inquiries.

Report of the committee on unemployment insurance in agriculture, R. H. REW ET AL. (*London: Agr. Wages Bd., 1921, pp. 18*).—On the basis of evidence derived from official reports, returns supplied by agricultural organizations, and various memoranda which are reproduced in the appendixes, this committee of the Agricultural Wages Board for England and Wales concludes that there is general opposition both by employers and workers to the inclusion of agriculture under the general provisions of the Unemployment Insurance Act, 1920; that there is no evidence that a special scheme for agriculture under this act would, or would not, be acceptable to employers or workers; and that there is no evidence of such general agreement as would be necessary for the consideration of a voluntary scheme of insurance against unemployment outside the act and independent of State aid.

A century of Missouri agriculture, F. B. MUMFORD (*Missouri Hist. Rev., 15 (1921), No. 2, pp. 277-297, pls. 3*).—This sketch covers the early settlement of the land by the French pioneers, farming and living conditions, statistics of production and yield per acre of corn and wheat in the census years 1839 to 1909, inclusive, and prices of farm products since 1866. Brief notes on farmers' organizations in the State, and an account of the origin and growth of the agricultural college, the experiment station, and the State board of agriculture are given.

Economic problems of Argentina, E. LAHITTE (*Rev. Tierras y Colon., 2 (1921), Nos. 9, pp. 155-163; 10, pp. 208-213; 11, 245-252*).—A few statistics setting forth the population, agricultural area, area in cultivation, rate of immigration, and other economic information for Argentina are noted. The discussion which follows is devoted to the progress of agricultural colonization, plans for the encouragement of immigration to Argentina, and credit needs, particularly for agricultural industries. Comparisons are made between conditions that prevailed in the United States during the period of rapid agricultural development and precedents followed then and conditions existing in Argentina now.

Reviving an ancient granary, H. A. BELLOWES (*Northwest. Miller, 128 (1921), No. 5, pp. 523, 524, 536-539, figs. 10*).—This article sets forth the effect of the extensive irrigation engineering works along the Nile in increasing the area available for cultivation in wheat and cotton.

Suggested reclassification and revision of sections of the tariff relating to agricultural products and provisions, T. W. PAGE ET AL. (*Washington: Govt., 1921, pp. 11+226*).—This report to Congress, prepared by the U. S. Tariff Commission, suggests reclassification and revision of schedule G and of related provisions of the Tariff Act of October 3, 1913, dealing with agricultural products and provisions. It consists of two sections, part 1 presenting the acts of 1909 and 1913, the emergency tariff of May 27, 1921, with suggested revision in names or descriptions of commodities and more specific provision for commodities now dutiable under basket or general clauses, and explanatory comment. Part 2 contains statistical matter relating to the domestic production, imports, and exports of the commodities considered. Information is included for use in computing differences in the rates of duty upon raw materials and their derivatives.

The present status of agricultural cooperation in Yugoslavia, M. OBULJEN (*Italia Agr., 58 (1921), No. 10, pp. 289-292*).—The communistic organization of Slavic nations based on the zadruga or clan unit is said to favor the development of modern cooperative organization. Mention is made of certain leaders in the movement in Serbia and neighboring States for the organization and federation of agricultural societies.

Rural community progress in Kansas, W. BURR (*Kans. State Bd. Agr. Bien. Rpt.*, 22 (1919-20), pp. 215-225, figs. 7).—This article describes the community building activities of certain rural schools and churches in the State.

Agricultural statistics: Their collection and use, H. REW (*Jour. Min. Agr [London]*, 28 (1921), No. 7, pp. 636-644).—The history of the establishment of a national system of collecting agricultural statistics for Great Britain is sketched. The importance of the statistics to the producer, trader, administrator, economist, and sociologist is mentioned.

The Market Reporter (*U. S. Dept. Agr., Market Rptr.*, 4 (1921), Nos. 24-26, pp. 369-384, figs. 3; 27, pp. 385-400).—The usual current market information is offered in these numbers in special articles and tabulations of market statistics dealing with the important classes of agricultural products. In No. 24-26 is given a review of foreign trade statistics, with graphs showing monthly trends of exports and tabulations of exports of principal agricultural products in September and October. Comparisons are made between the quantity and value of exports during these months in 1921 and in the preceding year. In No. 27, there appears a summary of statistics of the world cotton crop in 1921 and comparisons with earlier years.

Report on the grain trade of Canada, 1920, W. DOUGAN (*Canada Bur. Statis., Rpt. Grain Trade Canada, 1920*, pp. 107, pl. 1, figs. 3).—Statistics for the crop year ended August 31 and to the close of navigation, 1920, are assembled, indicating in detail the various channels and markets through which the grain passes from the farm to its final disposition. Comparative data are included for other countries than Canada.

The first part deals with the production, inspection, and handlings at country and interior, public, and private terminal elevators in the West and at public elevators in the East, including handlings of the United States grain in the eastern elevators. Tables have been added showing exports of grain from Canada by ports of exit and countries of destination. Monthly average cash prices of wheat, oats, and barley at Winnipeg are shown for the last four years by chart. Average future options on oats, barley, flax, and rye at Winnipeg, Minneapolis, and Chicago are tabulated.

[**Agricultural statistics of Canada**] (*Canada Yearbook, 1920*, pp. 188-278, fig. 1).—The section continuing information previously noted (*E. S. R.*, 44, p. 91) has been considerably increased in this volume, especially in regard to recording and analysis of agricultural prices from about 1909 to 1920.

Economic notes on Brazil (*Rio de Janeiro: Min. Agr., Indus. and Com.*, 1921, 4. ed., pp. 117).—This compilation of information on production and trade in important crops continues the series of reports previously noted (*E. S. R.*, 43, p. 595).

Prices and supplies of grain, live stock, and other agricultural produce in Scotland, J. M. RAMSAY (*Scot. Agr. Statis.*, 8 (1919), No. 3, pp. 81-113).—These statistics for 1919 continue the series of annual reports previously noted (*E. S. R.*, 44, p. 694).

[**Agricultural statistics of Scotland, 1920**], J. M. RAMSAY (*Scot. Agr. Statis.*, 9 (1920), Nos. 1, pp. 55; 2, pp. 57-79; 3, pp. 81-113).—These reports continue to date statistics of acreage and live stock returns and returns of produce of crops in Scotland, with a summary for the United Kingdom, also of prices and supplies of grain, live stock, and other agricultural produce, as previously noted (*E. S. R.*, 44, pp. 694, 792; and above).

[**Agricultural statistics of Denmark**] (*Statis. Aarbog Danmark*, 26 (1921), pp. 34-55).—These pages continue statistical reports on valuation of agricultural property, area cultivated, and crops and live stock produced, as previously noted (*E. S. R.*, 45, p. 90), by adding statistics for 1920.

Agriculture and related industries [in Switzerland], H. L. GROVES (*U. S. Dept. Com., Bur. Foreign and Dom. Com., Spec. Agents Ser., No. 210 (1921), pp. 37-45, pls. 2*).—Features of this report are a tabulation of estimates of the annual consumption of cereals and potatoes in Switzerland in 1913, 1918, and 1919 and of cereal imports for a number of years by sources, and descriptive notes covering a few of the important agricultural industries, methods, dairy equipment, trade in cheese and condensed milk, and farmers' collective buying associations.

[Agricultural statistics of Egypt, 1919-1920] (*Ann. Statist. Egypte, 11 (1919), pp. 57-112; 12 (1920), pp. 57-112*).—These statistics of agricultural production and prices continue information previously noted (*E. S. R., 42, p. 392*).

[Agricultural statistics for Australia] (*Aust. Bur. Census and Statist., Prod. Bul. 14 (1921), pp. 9-72*).—These pages furnish a summary of statistics of land settlement, agricultural production, pastoral pursuits, and farmyard and dairy products by States and Territories of Australia during the decade 1909-10 to 1919-20, continuing the series previously noted (*E. S. R., 44, p. 792*).

Area and production of principal crops in Japan (*Tokyo: Dept. Agr. and Com., Bur. Agr., 1921, pp. 21*).—Statistics are given showing the area, production, and yields per acre of important crops in a number of years and averages for periods of years. Index numbers are also tabulated.

AGRICULTURAL EDUCATION.

Agricultural education, L. DU PREY (*Rev. Vitic., 55 (1921), No. 1430, pp. 381-384*).—An historical résumé is given setting forth in particular the success of the National School of Agriculture at Montpellier and its influence on agricultural education in France.

Agricultural schools in Czecho-Slovakia, F. SITENSKÝ (*In Czecho-Slovak Republic. Prague: Czecho-Slovak Foreign Off., 1919, vol. 6, pt. 4, pp. [31], figs. 20*).—The agricultural school system in Bohemia, Moravia, and Silesia is said to include practical farmers' schools and winter schools; special schools as, for example, a pomological institute, a viticultural school, schools for hop culture and flax culture, meadow-farmers' schools, and others, all of lower school grade; also higher agricultural schools offering a three years' course; and agricultural academies and universities. A few housekeeping schools are in existence, some experiment stations, and schools of forestry. Many of these are briefly described in this report.

Report of the agricultural high school of Berlin (*Ber. Landw. Hochsch. Berlin, 24-27 (1915-1919), pp. 120*).—Progress reports are made dealing with the various branches of this institution, changes in the personnel of the teaching force are noted, and financial and other administrative reports are submitted.

Report of the committee on teaching [of agricultural economics] for the year 1920, W. E. GRIMES (*Jour. Farm Econ., 3 (1921), No. 2, pp. 100-102*).—The text of the report previously noted (*E. S. R., 44, p. 197*) is published here.

The home project as a method of teaching home economics, T. E. KAUFFMAN (*Jour. Home Econ., 13 (1921), No. 12, pp. 592-596*).—Several aspects of the home-project method applied to the teaching of home economics are briefly discussed. It is specially recommended for small schools and some of the larger junior high schools. Its introduction into large high schools with their present organization is thought to be difficult.

A week's supply of food for an average family, C. L. HUNT (*U. S. Dept. Agr., States Relat. Serv., Food Selection and Meal Planning Charts 1-8 [1921]*).—A pictorial guide to correct diet is presented in this set of charts on food selection and meal planning. No. 1 classifies the week's supply of food for an average family in five groups giving portions of each needed. Nos. 2, 3, 4, 5, and 6 illustrate each of the groups, namely, vegetables and fruits; milk, meat, and similar foods; cereals; sugar and other sweets; and fats. The last two are descriptive and explanatory, No. 7 furnishing the basis of calculating the cost showing the number of 100-calorie portions in foods as purchased, and No. 8 that of comparing one individual or family with the average in purchasing the food supply.

MISCELLANEOUS.

Report of Kansas Station, 1920, F. D. FARRELL (*Kansas Sta. Rpt. 1920, pp. 99*).—This contains the organization list, a financial statement for the fiscal year ended June 30, 1920, and a report of the director summarizing the work and publications of the station. The experimental work recorded not previously noted is for the most part abstracted elsewhere in this issue. A list of the publications of the station staff to December 31, 1920, classified by departments, is appended.

Thirty-third Annual Report of Michigan Station, 1920, R. S. SHAW ET AL. (*Michigan Sta. Rpt. 1920, pp. 227-693, figs. 79*).—This contains a financial statement for the year ended June 30, 1920; reports of the director and heads of departments on the work of the station during the year, the experimental features of which have been for the most part abstracted elsewhere in this issue; and reprints of Bulletins 285-287, Special Bulletins 98-101, Technical Bulletins 45-48, and Circulars 41-43, all of which have been previously noted.

Bimonthly Bulletin of the Western Washington Substation (*Washington Sta., West. Wash. Sta. Bimo. Bul., 9 (1922), No. 6, pp. 81-100, figs. 4*).—In addition to articles abstracted elsewhere in this issue, this number contains brief articles entitled Top Grafting to Increase Fruit Crops, by J. L. Stahl; The Why of the Purebred Dairy Cow, by H. E. McNatt; Chick Health and Feeding, by W. T. Johnson; Raising Rabbits, by A. D. Norris; and Sheep for Western Washington.

NOTES.

Connecticut State Station.—Dr. Thomas B. Osborne was one of four investigators recently awarded the John Scott Medal and Certificate with premium of \$800, the award being made for his researches on the constitution of the vegetable proteins.

Illinois University and Station.—The resignation of Dr. Eugene Davenport, dean of the College of Agriculture and director of the station since 1895, has been accepted by the board of trustees to take effect September 1.

Purdue University.—The corner stone is soon to be laid for the Memorial Union Building. This will be a massive two-story structure, affording quarters for the various student activities, and costing about \$1,250,000.

Missouri Fruit Station.—Recent appointments include H. W. Guengerich as extension horticulturist, C. R. Phipps as entomologist, and A. S. Rhoads as pathologist.

New York State Station.—The station is assisting in the further testing, production, sale, and distribution of new and valuable varieties of fruit trees, plants, vines, and bushes, which it has originated or approved by means of an organization of fruit growers known as the New York State Fruit Testing Cooperative Association, Inc. Any fruit grower is eligible to enroll in this association upon the payment of a small annual fee. He is then entitled to one new variety as a membership premium and to a list of available stock which may be purchased at the approximate cost of growing and distribution. At present the members are scattered over 24 States and Canada, although no special effort has been made to obtain members owing to the limited amount of stock available.

During the past season six varieties of plums, four of grapes, three of raspberries, two each of apples and cherries, and one each of pears and gooseberries have been sent out by the station for further testing by the members of the association. In addition, a number of other varieties are being propagated for further distribution. Among the varieties recommended by the station for testing under different conditions are the Golden Delicious, Tioga, and Cortland apples; the Cayuga pear; the Wilma peach; the Imperial Epineuse. Agen, Formosa, Drap d'Or, Oullins, and Pacific plums; the Chase sour cherry and Ida sweet cherry; the Poorman gooseberry; the Donboro, June, and Ontario red raspberries; and the Portland, Brockton, and Ripley white grapes and the Canandaigua and Sheridan black grapes.

Oregon College.—The regents have approved a campaign initiated by the student body for a \$300,000 student union building to be financed by the students themselves, together with alumni and friends. Under the plan proposed each student will pay \$3 per term into the building fund.

Wisconsin University.—Franklin A. Nace, of Iola, a former student of the College of Agriculture, has been appointed to the board of regents. He is said to be the first farmer appointed to this position.

Minnesota State Flour Testing Mill.—A recent number of *Northwestern Miller* contains a description of the experimental flour mill built in Minneapolis by the State of Minnesota and put in operation in the fall of 1921. This mill has been built under an authorization by the legislature to the

State Railroad and Warehouse Commission in 1919 to expend not to exceed \$35,000 from its grain inspection fund for this purpose. In 1920 a brick structure 32 by 60 feet was erected, but a supplementary appropriation of \$50,000 was required for the installation of machinery, which was provided by the legislature in 1921. At the same time jurisdiction over the enterprise was transferred to the State department of agriculture. C. H. Bailey, associate biochemist of the Minnesota University and Station, in charge of cereal technology, has given much attention to the technical equipment and installation, and under a cooperative arrangement serves as director of the experimental mill.

The mill has been so arranged as to provide for the convenient handling of wheat in car lots, including an elevator system, cleaning machinery, and bins with a combined capacity of about 3,200 bushels. Very complete milling machinery has also been installed, including in the grinding department 7 double stands of 7 by 16 inch rolls, providing 5 breaks, a sizings, 6 middlings, and 2 tailings reductions. The system is said to be much more extensive than that of the ordinary 150-barrel mill.

Much special machinery is provided for securing experimental data. A well equipped laboratory is included in the plant with facilities for milling small samples, conducting baking tests, and making moisture, ash, crude protein, and other routine analyses. The laboratory is not intended primarily for research, however, but rather as a control laboratory for checking up the mill's operations and for testing grain for parties desiring this service.

The purpose of the plant as a whole will be twofold. Adequate tests will be possible of the principal types and grades of wheat entering the Minnesota markets, as well as studies of the effect of various factors upon milling and baking quality. The second purpose will be to supply the various State institutions with flour.

Ultimately it is thought probable that instruction may be offered for millers, though no provision for the necessary staff has thus far been made. The mill will be used at times by the University of Minnesota, however, for the training of milling chemists, the first course being offered during the present spring.

Miscellaneous.—Word has been received from Maj. Albert Bruno, editor of *Annales de la Science Agronomique*, that he would appreciate receiving reprints of papers by American investigators for review in that publication. Reprints may be addressed to Major Bruno at Ministère de l'Agriculture, 42 bis, Rue de Bourgogne, Paris, France.

Harry M. Lamon, for the last 10 years in charge in poultry work of the Bureau of Animal Industry, U. S. Department of Agriculture, resigned March 1, to engage in commercial work in Minnesota. A. R. Lee has been designated as acting in charge of the poultry work of the department.

Dr. Charles D. Woods, formerly director of the Maine Station, has been appointed director of agricultural information in the Massachusetts Department of Agriculture.

Among others recently knighted by King George V was J. B. Harrison, director and government analyst in the Department of Science and Agriculture of British Guiana.



EXPERIMENT STATION RECORD.

VOL. 46.

ABSTRACT NUMBER.

No. 6.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

The chemistry of colloids and some technical applications, W. W. TAYLOR (London: Edward Arnold & Co.; New York: Longmans, Green & Co., 1921, 2 ed., [rev. and enl.], pp. VIII+332, figs. 22).—This is a revised edition of the volume previously noted (E. S. R., 33, p. 801).

The chemistry of spray mixtures, H. M. NICHOLS (*Tasmania Agr. and Stock Dept. Bul.* 97 (1920), pp. 7).—This bulletin is designed to explain in simple terms to the nontechnical fruit grower the chemical nature of the ingredients of various fungicides and insecticides and the reactions which take place in their manufacture.

Changes in the composition of paprikas during the growing period, A. F. SIEVERS and J. D. MCINTYRE (*Jour. Amer. Chem. Soc.*, 43 (1921), No. 9, pp. 2101-2104).—Analyses of the fruit of the paprika (*Capsicum annuum*), at six stages of growth, were made at the Bureau of Plant Industry, U. S. D. A., for the purpose of tracing the development of the pungent principle and sugar in the fruit as it grows and matures. The analyses, which included moisture, ash, ether extract (volatile and nonvolatile), alcohol extract, and reducing and total sugars, were made on the air-dried pods from which the stems and calyxes had been removed.

Both the ash and ether extract showed definite changes during the several stages, the former decreasing from 8.13 per cent in the small immature fruit to 6.78 per cent in the mature red fruit, and the total ether extract increasing from 2.14 to 9.18 per cent. The increase in nonvolatile ether extract took place rather gradually, while in the volatile extract representing the volatile oil practically all the increase took place at the end of the growing period. The alcohol and sugar extracts showed no definite changes but considerable fluctuations.

As a means of determining roughly the relative pungency of the different samples, a definite quantity of each was triturated in a mortar with sugar added a little at a time until a small quantity of the mixture produced no distinctly pungent taste. The amount of sugar required to mask the pungency of 0.2 gm. of the paprika from the first to the last stage was 0.39, 5.55, 5.52, 7.6, 12.48, and 32.2 gm.

It is concluded that the ether extract is a fairly accurate measure of the maturity of the paprikas provided that the normal ether extract of an average sample of such peppers is known for comparison.

The influence of certain factors upon the chemical composition of sauerkraut. O. R. BRUNKOW, W. H. PETERSON, and E. B. FRED (*Jour. Amer. Chem. Soc.*, 43 (1921), No. 10, pp. 2244-2255, fig. 1).—The authors at the Wisconsin Experiment Station have made a detailed study of the chemical changes taking place in the formation of sauerkraut during a normal fermentation, and the influence of the inoculation of various organisms and of salt concentration on the products formed and on the quality of the sauerkraut.

The best product was obtained when approximately 2 per cent of salt was used. With a salt concentration above 3 per cent the product was tough and too soft, and below 2 per cent of very inferior quality.

Inoculations with certain organisms produced a better grade of sauerkraut than is produced by natural fermentation, the best results being obtained with *Bacterium lactis acidii*. It is thought, however, that further experiments are needed before inoculation on a commercial scale can be recommended.

The chief products formed in the fermentation were lactic acid, acetic acid, and ethyl alcohol. Mannitol in varying amounts may also be formed, depending upon the type of organisms present.

The bacteriology of sauerkraut and pickles. E. LEFEVRE (*Chem. Age [New York]*, 30 (1922), No. 1, p. 34).—A brief discussion is given of factors influencing the brine fermentation of cabbage and cucumbers. Experiments conducted at the Bureau of Chemistry, U. S. D. A., have shown that cucumbers infected with mosaic show great loss in curing.

A note on the oil of oats. E. PAUL (*Analyst*, 46 (1921), No. 543, pp. 238, 239).—Freshly ground oats of the variety known as Black Tartary, on drying to a moisture content of 4 per cent at 36° C., extracting with petroleum ether, filtering the extract through kaolin and kieselguhr, and evaporating the solvent yielded a semisolid mass consisting largely of lecithin. This was removed by dissolving the mass in ether, precipitating with acetone, and filtering by suction. The oil obtained by evaporation of the filtrate to constant weight gave the following constants: Melting point approximately 8°, specific gravity at 15° 0.925, acid value 68.90, free fatty acid as oleic acid 34.70, neutral fat 64 per cent, saponification number 189.8, iodine number (Wijs) 114.2, unsaponifiable matter 1.3, and refractive index 1.4701.

Safflower oil. A. HOWARD and J. S. REMINGTON (*Agr. Research Inst. Pusa Bul.* 124 (1921), pp. 14).—This bulletin contains a classification of 24 types of Indian safflower (*Carthamus tinctorius*) described in a former publication (E. S. R., 36, p. 228), and the report of a technical investigation under commercial conditions of safflower seed, conducted with a view to determining its economic possibilities in the British market.

The oil obtained by extracting the hot crushed seed with benzol gave the following constants: Specific gravity at 15.5° C. 0.9258, acid value 9.78, acidity (calculated as oleic) 4.91 per cent, saponification value 197.31, ester value 187.53, relative viscosity (water=1) 8.4, butyro-refractometer at 15.5° 78, refractive index at 15.5° 1.4771, unsaponifiable matter 1.25 per cent, and glycerol 4.26 per cent.

Tests of the oil with various commercial driers showed that with cobalt resinate in the proportion of 1 lb. of the resinate to 33 of the oil a very satisfactory drying oil, comparing favorably with linseed oil, can be prepared. Other possible uses of the oil are in the manufacture of soap, in the preparation of enamels and artists' colors, and as an edible oil. For the last two purposes the oil should be bleached—by an oxidizing agent if it is to be used in paints, and by filtration through fuller's earth or animal charcoal if it is to be used for edible purposes.

The characteristics of certain pentose-destroying bacteria, especially as concerns their action on arabinose and xylose, E. B. FRED, W. H. PETERSON, and J. A. ANDERSON (*Jour. Biol. Chem.*, 48 (1921), No. 2, pp. 385-412, pls. 2).—Continuing the study of pentose-destroying bacteria previously noted (E. S. R., 43, p. 610), the authors have made a detailed study of the fermentative ability, particularly for arabinose and xylose, and of the general characteristics of 12 cultures of bacteria obtained from various samples of corn silage and sauerkraut taken at different stages of their fermentation, usually between the tenth and twenty-first day.

These 12 cultures were found to fall in two groups distinguishable by their action on milk and fructose. All of the strains in group 1 coagulate milk slowly and do not form mannitol from fructose, while all the strains of group 2 form mannitol from fructose and do not coagulate milk. A further division of each group is made as follows:

"Group I.—Strain A ferments arabinose, xylose, and lactose, but does not ferment melezitose or dulcitol. Strain B ferments arabinose, xylose, lactose, and dulcitol, but does not ferment melezitose. Strain C ferments arabinose, lactose, and melezitose, but does not ferment xylose or dulcitol.

"Group II.—All strains ferment arabinose and xylose, but do not ferment lactose, melezitose, or dulcitol."

The authors suggest as names for these types of lactic bacteria *Lactobacillus pentosus* for strains A and B and *L. arabinosus* for strain C of group 1, and *L. pentoaceticus* for group 2.

The quantitative determination and identification of the products formed from arabinose and xylose by the action of these bacteria gave results confirming those of a previous report (E. S. R., 43, p. 411). Acetic acid and lactic acid were formed in amounts equivalent to about 90 per cent of the sugar destroyed and 98 per cent of the isolated products and in the ratio of 1 molecule of acetic to 1 molecule of lactic acid. The only other product that could be identified was carbon dioxid, which is produced in minute quantities only.

An apparatus for the estimation of catalase, W. H. WELKER (*Jour. Lab. and Clin. Med.*, 7 (1921), No. 3, pp. 173-175, figs. 2).—An apparatus in which a series of catalase determinations can be made simultaneously, with uniform mechanical shaking and with provision for reasonably accurate measurement of the gas liberated, is described and illustrated.

Remarks on the determination of soil acidity by the iodine method, O. LEMMERMAN and L. FRESNIUS (*Jour. Landw.*, 69 (1921), No. 2, pp. 97-104, fig. 1).—The authors discuss certain sources of error in the quantitative iodine method for the determination of soil acidity, as described by Stutzer and Haupt (E. S. R., 34, p. 609). These include the absorption of the iodine solution by the filter paper, which can be remedied by filtering through asbestos, and incomplete reaction due to too short a period of shaking. In the experience of the authors it is necessary to continue the shaking for two hours at least to obtain quantitative results. Variations in the absorbing power of different soils for iodine are considered to introduce a further source of error. The authors conclude that the method is not suitable for quantitative determinations.

Determination of the monamino acids in the hydrolytic cleavage products of lactalbumin, D. B. JONES and C. O. JOHNS (*Jour. Biol. Chem.*, 48 (1921), No. 2, pp. 347-360).—This contribution from the Bureau of Chemistry, U. S. D. A., consists of the preparation of pure lactalbumin from milk, its hydrolysis, and the separation and determination of the monamino acids in

the hydrolysate by the newer methods of Dakin (E. S. R., 43, p. 111) and Foreman (E. S. R., 43, p. 202).

The lactalbumin was prepared from fresh skim milk by first precipitating the casein at 35° C. by N-hydrochloric acid at an H-ion concentration of pH=4.6, boiling the filtrate from the casein for 10 minutes to precipitate the lactalbumin, and drying with alcohol and ether and finally in the air. The protein was hydrolyzed by boiling for 40 hours with hydrochloric acid, specific gravity 1.1, and the monamino acids determined in the hydrolysate. The yield was as follows: Glycin 0.37, alanin 2.41, valin 3.30, leucin 14.03, prolin 3.76, phenylalanin 1.25, aspartic acid 9.30, glutamic acid 12.89, hydroxyglutamic acid 10.00, serin 1.76, and tyrosin 1.95 per cent. These results when compared with the recorded results of a previous hydrolysis of lactalbumin by Abderhalden and Präbram (E. S. R., 19, p. 979) show as outstanding features a much larger yield of aspartic acid and the isolation of glycine, serine, and hydroxyglutamic acid which have not been determined previously in the hydrolysis products of lactalbumin. The total percentage of monamino acids as determined in the present study is 61.02 per cent, as compared with a total of 41.15 per cent in the previous study.

The quantitative determination of amino acids of feeds, T. S. HAMILTON, W. B. NEVENS, and H. S. GRINDLEY (*Jour. Biol. Chem.*, 48 (1921), No. 2, pp. 249-272).—This paper reports in detail a method of determining the amino-acid content of feeds developed in the course of an extensive investigation of possible improvements in the technique previously described by Eckstein and Grindley (E. S. R., 40, p. 510). Data are also presented on the amino-acid content, as determined by the technique described, of oats, corn, cottonseed meal, and alfalfa.

The preliminary separation of the proteins consists in a series of extractions with various solvents and the separation of the proteins in extracts in which this is necessary. The essential features of this part of the procedure are as follows:

(1) The nonprotein nitrogenous constituents are extracted from a weighed quantity of the finely-ground feed equivalent to approximately 6 gm. of protein with anhydrous ether, cold absolute ethyl alcohol, and cold 1 per cent trichloroacetic acid in the order named. To the trichloroacetic acid extract colloidal ferric hydroxid is added to precipitate the small amount of protein contained therein. (2) The main portion of the proteins is next extracted with six successive portions of cold dilute sodium hydroxid. (3) The residue from the above treatment is digested on a steam bath three times with 2 per cent trichloroacetic acid to remove the starch, and the protein is separated from the starch by concentrating the united filtrates under diminished pressure to about one-third their original volume and precipitating the starch with alcohol. (4) The residue from the trichloroacetic treatment is boiled twice with 20 per cent hydrochloric acid for 3 minutes, cooled, filtered, and washed with ammonia-free water. (5) The above extract is then extracted for three 24-hour periods on the shaker with 5 per cent sodium hydroxid solution. The above procedure leaves the protein content in the following fractions: (1) The colloidal ferric hydrate precipitate from the cold 1 per cent trichloroacetic acid extract, (2) the dilute alkali extract, (3) the filtrate from the alcoholic precipitation of the starch, (4) the 20 per cent hydrochloric acid extract, and (5) the strong alkali extract. These are appropriately treated for hydrolysis, hydrolyzed separately by boiling for 15 to 20 hours under reflux condensers and then combined and analyzed by the Van Slyke method with a few modifications.

The average results expressed in percentage of total nitrogen obtained in the application of this method to the analysis of six samples of oats, six of corn, eight of cottonseed meal, and four of alfalfa are shown in the following table:

Nitrogen distribution in various feeding stuffs (results expressed as percentage of total nitrogen).

Form of nitrogen.	Oats.	Corn.	Cotton- seed meal.	Alfalfa.
	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>
Ammonia N.....	11.42	11.94	9.41	8.17
Humin N.....	5.53	3.54	6.30	7.36
Arginin N.....	11.65	8.73	18.71	8.00
Cystin N.....	.94	1.07	.94	.99
Histidin N.....	5.80	4.83	7.17	3.93
Lysin N.....	2.84	2.20	4.21	4.43
Amino acid N in filtrate from bases.....	42.14	46.70	40.72	38.03
Nonamino acid N in filtrate from bases.....	3.86	7.22	2.87	2.51
Ether-soluble N.....	.57	.33	.10	.55
Alcohol-soluble N.....	1.22	1.37	.55	1.85
Nonprotein N soluble in 1 per cent $\text{CCl}_3\text{CO}_2\text{H}$ —in filtrate from colloidal Fe.....	11.13	8.14	5.56	16.69
N lost in method of analysis.....	1.90	3.85	3.29	4.73
Total.....	99.00	99.92	99.83	97.24

A comparison of these results with those previously reported by Grindley et al. (E. S. R., 33, p. 805; 34, p. 412; 36, p. 205) and by Nollau (E. S. R., 33, p. 665) shows a lack of concordance which is thought to be due chiefly to differences in the methods used. The removal before hydrolysis of the nonprotein nitrogenous constituents, most of the carbohydrates, and the fiber is thought to obviate the objectionable features of the previous methods and to make for greater accuracy.

The proteins of cottonseed meal.—I, Amino acid content, W. B. NEVENS (*Jour. Dairy Sci.*, 4 (1921), No. 5, pp. 375-400).—This paper includes the data on the amino acid content of cottonseed meal presented in the paper of Hamilton, Nevens, and Grindley noted above, together with a new set of averages, using the four out of the eight sets of determinations which are considered for various reasons to express more nearly the actual composition of commercial cottonseed meal. The values expressed in percentage of total nitrogen are as follows: Ammonia N 9.49, humin N 6.58, arginin N 18.74, cystin N 0.90, histidin N 7.40, lysin N 3.81, amino acid N in filtrate from the bases 40.12, nonamino acid N in filtrate from the bases 2.68, and nitrogen recovered in preliminary extractions plus uncharacterized nitrogen lost in method of analysis 9.03 per cent.

A comparison is made between these results and those reported for corn, alfalfa, and oats in the above paper. The most striking difference is shown to be in the total basic amino nitrogen content, the values for the four feeding stuffs being alfalfa hay 17.412, oats 21.228, corn 17.529, and cottonseed meal 30.846 per cent of the total nitrogen. It is assumed that these wide differences in proteins of different feeding stuffs indicate similar differences in their nutritive value.

Determination of methyl alcohol in the presence of ethyl alcohol in spirits, medicinal and cosmetic preparations, etc., by means of the Zeiss immersion refractometer, W. LANGE and G. REIF (*Ztschr. Untersuch. Nahr. u. Genussmtl.*, 41 (1921), No. 9-10, pp. 216-226).—This paper describes a method for determining methyl alcohol in the presence of ethyl alcohol, which depends upon the fact that at a concentration of 50 per cent the specific gravity at 15° C. of methyl alcohol is practically the same as that of ethyl alcohol, 0.9347 and

0.9345, respectively. A 100 cc. sample is rendered slightly alkaline by the addition of 5 or 10 cc. of normal base and distilled with the use of a fractionating column until the temperature reaches 90°. The distillate is brought to a temperature of 15°, the volume noted, the specific gravity determined with a pycnometer, and the approximate alcohol strength found by reference to tables. Sufficient water is then added to the distillate to make the alcohol concentration 50 per cent by volume, and the solution is examined in a Zeiss immersion refractometer which gives a scale reading of 40.2 for a 50 per cent solution of methyl alcohol and 85.6 for ethyl alcohol of the same concentration.

Tables have been calculated showing the percentages of methyl alcohol corresponding to readings between these limits.

The estimation of inorganic phosphorus in blood plasma by the method of Bell and Doisy, B. A. MYERS and M. C. SHEVKY (*Jour. Lab. and Clin. Med.*, 7 (1921), No. 3, pp. 176-180, figs. 3).—Attention is called to certain difficulties which the authors have met with in the practical application of Bell and Doisy's method of determining inorganic phosphorus in blood plasma (*E. S. R.*, 44, p. 613, and suggestions for overcoming these difficulties are made. The series of standards must be prepared of differing phosphorus content so that in each determination one may be selected which contains phosphorus in an amount which does not exceed that of the unknown by more than 0.25 mg. per 100 cc. In certain plasmas larger amounts of molybdic acid and hydroquinone solutions must be added.

Use of invertase for sucrose estimation, T. S. HARDING (*Sugar [New York]*, 23 (1921), No. 10, pp. 546-548).—A brief discussion of the advantages in the use of invertase for sucrose determinations by the Clerget method.

The determination of reducing sugars in lead-preserved cane juices, J. B. HARRIS (*Jour. Indus. and Engin. Chem.*, 13 (1921), No. 10, pp. 925, 926).—Determinations of reducing sugars on juice samples preserved with basic lead acetate, after deleading with the usual normal salts, have been found to give too low results. With the use of an acid deleading agent before filtering, the full percentage of reducing sugars in lead-preserved samples can be obtained. Oxalic acid has been found to be the most effective reagent tried for this purpose.

Table for the determination of dextrose, invert sugar, and levulose by the thiocyanate-potassium iodid method, G. BRUHNS (*Chem. Ztg.*, 45 (1921), No. 61, pp. 486, 487).—To supplement the author's previous papers on the determination of invert sugar with potassium thiocyanate and potassium iodid (*E. S. R.*, 43, p. 314), a table is given showing the amount of dextrose, invert sugar, and levulose corresponding to different amounts of thiosulphate required for titration.

The determination of glucose, fructose, sucrose, and dextrin in the same material, A. BEHRE (*Ztschr. Untersuch. Nahr. u. Genussmit.*, 41 (1921), No. 9-10, pp. 226-230).—For determining different kinds of sugar in the same material as in natural and artificial honey, the author suggests the application of the method of determining glucose with hypiodid described by Willstätter and Schudel (*E. S. R.*, 40, p. 312). Glucose is determined according to the usual technique of this method. For sucrose the determination is made before and after hydrolysis with hydrochloric acid. For determining glucose and dextrin in commercial corn sirup, glucose determinations by the iodine method are made before and after hydrolysis for two or three hours with hydrochloric acid. The difference in readings multiplied by the factor 0.9 gives the amount of dextrin. To determine the amount of fructose in the presence of glucose, the fructose is determined by the copper reduction method after the reduction of the glucose with iodine and the removal of excess iodine and the gluconic acid.

The examination of artificial and natural honeys, beet sugar sirups, etc., G. BRUHNS (*Chem. Ztg.*, 45 (1921), Nos. 83, pp. 661-664; 85, pp. 681, 682; 86, pp. 685-687; 89, pp. 711, 712; *abs. in Jour. Soc. Chem. Indus.*, 40 (1921), No. 17, p. 633 A).—The author describes methods used in an extensive examination of artificial honeys. This study has led to the conclusion that, owing to the dextrinous condensation products invariably present in artificial honeys prepared from sucrose by inversion and which are only partially hydrolyzed by the Clerget process, this process is of little use in the examination of honeys except to detect large quantities of sucrose. In place of this process, the author recommends hydrolysis by heating a 1 per cent solution of the honey in 0.06 N-hydrochloric acid in a boiling-water bath until inversion is complete. This is determined by withdrawing and testing portions of the solution until the maximum reducing power is reached. A correction depending upon the length of heating required is then made for the levulose destroyed.

After hydrolysis by this method artificial honeys showed invert sugar contents agreeing to within 0.5 per cent with the content of total solids. Edible beet sirups containing from 15 to 30 per cent of sucrose and about 2 per cent of ash gave results about 6 or 7 per cent higher than after hydrolysis by the Clerget method, but 8 or 9 per cent lower than the content of dry substance. Starch dextrins required a much longer time for hydrolysis than honey dextrins under the given conditions.

Dry substances in molasses, sirups, and juices by the Spencer electric oven, G. P. MEADE (*Jour. Indus. and Engin. Chem.*, 13 (1921), No. 10, pp. 924, 925).—The Spencer electric drying oven (E. S. R., 45, p. 313) has been found to be suitable for determining dry substance in solutions such as molasses, sirups, etc. The capsule is filled with freshly ignited fluffy asbestos loosely packed. After the weight of the capsule and asbestos has been taken, the liquid to be dried is run on the asbestos drop by drop in an amount not to exceed 4 cc., and the capsule with the sample is again weighed and placed in the oven previously heated to 110° C. The temperature is maintained at this point throughout the heating period, during which a strong current of air through the oven is required. At the end of the period the electricity and air are both shut off and the capsule is removed to a desiccator, cooled, and weighed.

It is stated that known solutions of sugar and of invert sugar and salt are dried to practically constant weight in 20 minutes, and that thin solutions of low viscosity such as cane juice are fully dried in 10 minutes. Molasses, sirup, and honey should be diluted 1:1 by weight with water before drying and should then be heated for 20 minutes at 110°, with no attempt at reaching constant weight by extra heating periods.

The comparative values of decolorizing carbons, A. B. BRADLEY (*Internatl. Sugar Jour.*, 23 (1921), No. 272, pp. 455-461, fig. 1).—This paper is primarily a discussion and criticism of the method recommended by Thomas for determining the comparative values of decolorizing carbons (E. S. R., 46, p. 12).

As a substitute method, the author recommends that a standard tintometer or colorimeter, preferably the Hess-Ives tint-photometer, be adopted and used by all workers. A standard concentration of solution should be used as suggested by Thomas, preferably a 50 per cent solution of raw cane sugar. The commercial carbon having the greatest decolorizing effect on 3 per cent of the standard solution should be taken as the standard carbon to which all others should be compared. Comparative treatments of both the standard carbon and the samples under examination should be made and the decolorizing results obtained plotted as curves. The time required for filtering off a given volume

of the standard sugar solution after treatment by the carbons under examination should be observed for comparison. The composition of the sample as regards size of grain should be determined approximately, and the volume for a common weight should be taken.

Use of kieselguhr in the clarification of cane juice, H. S. PAINE and C. F. WALTON, JR. (*Abs. in Science, n. ser.*, 53 (1921), No. 1368, pp. 266, 267).—A brief report is given of an investigation of the clarifying efficiency for cane juice of various types of kieselguhr.

One of the methods used to determine the clarifying efficiency consisted in the dialysis of the colloids present in the juice before and after clarification. The results thus far obtained show that if a sufficient amount of kieselguhr is used to afford the minimum adsorbing surface required for the colloids present, there is little, if any, difference in the clarifying efficiency of equal weights of different kieselguhrs. It is conceded that heating and filtration with kieselguhr remove all colloids of such a degree of dispersion as to give a turbidity visible to the eye, and subsequent treatment with decolorizing carbon removes colloids of such dimensions as to be invisible to the eye.

The effect of some decolorizing carbons upon the color and colloids of cane juice, J. F. BREWSTER and W. G. RAINES, JR. (*Jour. Indus. and Engin. Chem.*, 13 (1921), No. 10, pp. 921-923).—The authors at the Bureau of Chemistry, U. S. D. A., and the Louisiana Sugar Experiment Station have compared the efficiency in sugar clarification of four commercial decolorizing carbons with respect to the removal of colloids and of color from the juice. For the purpose of comparison a few runs were made with the sulphur-lime process, the rest being made with successive kieselguhr and carbon treatments. The amount of colloids left after the various treatments was determined by the dialysis method suggested by Paine and Walton as noted above, and the color by colorimetric determinations with the Hess-Ives tint-photometer, as described by Meade and Harris (*E. S. R.*, 43, p. 714).

A smaller amount of colloids was found in the juice after kieselguhr treatment alone than after the sulphur-lime treatment. Centrifuging the raw juice before treatment with kieselguhr resulted in slightly lower figures for colloids after the kieselguhr treatment, although a large amount of the material removed by centrifugation can also be removed by kieselguhr. Considerable variation was shown both in the colloids and in the color left in the solution after treatment with the different carbons. Tests on the repeated use of carbons showed that in the case of one carbon only was it possible to obtain good decolorization on a second filtration.

The effect of varying H-ion concentration upon the decolorization of cane juice with carbon, J. F. BREWSTER and W. G. RAINES, JR. (*Jour. Indus. and Engin. Chem.*, 13 (1921), No. 11, pp. 1043, 1044).—In connection with the investigation of the action of decolorizing carbons on cane juice noted above, preliminary work on the effect of H-ion concentration of the juice on the resulting decolorization is reported, the determinations being made with the spot test colorimetric method.

Increase of H-ion concentration was found to bring about an increase of decolorization, but, in view of the fact that the rate of inversion of sucrose increases in proportion to an increase in the concentration of the H-ion, it is thought to be somewhat doubtful whether much advantage would be gained in practice by acidifying to improve decolorization unless conditions were very carefully controlled.

The manufacture of starch from rice, F. B. WISE (*Rice Jour. and South. Farmer*, 24 (1921), No. 11, pp. 32, 33).—The author describes briefly the

processes involved in the manufacture of starch from rice, showing why rice is not used to a greater extent in the manufacture of starch.

The exploitation and utilization of grape marc, J. VENTRE (*Ann. École Natl. Agr. Montpellier, n. ser.*, 17 (1919), No. 1, pp. 3-70, figs. 5).—This is a discussion of the practical utilization of grape marc for the manufacture of alcohol, the residue after distillation for the extraction of tartaric acid, the recovery and utilization of the seeds for oil, and the utilization of the residue after the removal of the seeds for feeding stuffs and fertilizers.

The industrial manufacture of alcohol from carob beans, J. MEZZADROLI (*Bul. Assoc. Chim. Sucr. et Distill.*, 38 (1921), No. 12, pp. 510-517).—The author describes the methods employed in a large establishment in Sicily for the manufacture of alcohol from carob beans. The sugar is extracted by diffusion at a temperature of from 95 to 105° C. and fermented aseptically with selected yeasts, after which the alcohol is distilled. The composition of the Sicilian carob bean is given as follows: Moisture 17, reducing sugars calculated as glucose 15, sucrose 25, protein 4.70, tannic acid 1.52, fat 0.60, ash 2.40, non-nitrogenous organic matter 22, and cellulose 4.55 per cent.

Some factors of dehydrater efficiency, W. V. CRUESS and A. W. CHRISTIE (*California Sta. Bul.* 337 (1921), pp. 277-298, figs. 8).—This publication is essentially a progress report on a comparison of the efficiency of various types of dehydraters in use in California. Data are presented on the cost of dehydration in dehydraters of various designs and capacity, and of the fuel efficiency and air-flow requirements of the different types of dehydraters.

It is estimated that a completely equipped and satisfactory dehydrater can be built for \$500 or less per green ton capacity per 24 hours. The air-blast tunnel type of dehydrater has been found to be the most economical to operate in regard to fixed charges and operating costs. Emphasis is placed on the importance of adequate air flow. It is considered that the velocity of air across the trays should not fall below 500 ft. per minute for fruits which case-harden and 750 ft. per minute for freely drying fruits. It is thought probable that velocities of 800 to 1,000 ft. per minute in the case of very easily dried fruits, such as grapes and sliced apples, would hasten drying sufficiently to compensate for the increased cost of power for the fans.

In tunnel dehydraters the "parallel current" system, in which the fruit enters at the air-intake end of the drying compartment and leaves at the air-exhaust end, is thought in general to be superior to the older "counter current" system in which the fruit enters at the air-exhaust end and leaves at the air-intake end. The advantages for the parallel current system are that the evaporation of surplus moisture is very rapid during the early stages of the drying period, when the fruit is in the best condition to give up its water; the wet fruit is more nearly at the temperature of the wet-bulb thermometer on account of the rapid rate of evaporation of the fruit, which reduces its temperature proportionately; scorching and overdrying are avoided, as the temperature is gradually lowered and the humidity raised; and the fruit emerges after drying at a relatively low temperature so that much less heat is carried to the outside atmosphere and lost.

Recirculation of a large proportion of the air used in drying, proper distribution between the trays of fruit, the use of multivane or steel plate fans, the selection of the proper type of trays for different fruits, and the control of humidity by air humidifying devices are all considered important factors in efficient drying. Wooden trays are recommended for the drying of sulphured fruits and screen trays for unsulphured fruits. Prunes and grapes are most rapidly dried if previously dipped in a boiling lye solution. Whatever the type

of dipping machine used, it is essential that the lye solution be maintained at or very near the boiling point during the dipping.

METEOROLOGY.

[Weather conditions in the United States during 1921] (*U. S. Dept. Agr., Weather, Crops, and Markets, 1 (1922), No. 2, pp. 17, 46, 47*).—It is shown in this review that the weather conditions during 1921 were on the whole “rather favorable for winter grains, corn, and citrus fruits, and, in most localities, for grasses and many minor crops, but unfavorable for cool-weather, spring-planted crops (such as oats, spring wheat, and potatoes), for deciduous fruits, and mostly unfavorable for cotton.

“The outstanding features of the season’s weather were the severe spring freezes that caused the destruction of most fruits throughout the Central States from the Great Plains eastward; the warm, dry weather that greatly damaged spring oats, spring wheat, and potatoes during their critical period of growth; and the tropical storm that crossed central Florida the latter part of October, resulting in much damage to citrus fruits in that section.”

The cotton crop of 1921 was the smallest in many years. “Unfavorable weather conditions and the unusually heavy damage by boll weevil were the major factors contributing to this result.” The apple crop of 1921 was the smallest in 30 years and the peach crop the smallest in 18 years. This was due to damage caused by frosts and freezes in March and April.

Report of weather observations, W. SCHIEFERSTEIN (*New Jersey Stat. Rpt. 1920, pp. 91, 92*).—This is a summary of observations on temperature and precipitation at the agricultural college farm at New Brunswick, N. J., during the year ended June 30, 1920.

The total rainfall during the year was 53.79 in., or 5.03 in. above the normal. “The snowfall also was above normal, the ground being covered with snow and ice during the greater part of the winter. The severe winter was followed by a late spring, with very unfavorable conditions for pollination during the season in which most fruit trees were in blossom.”

Ohio weather for the year 1920, W. H. ALEXANDER and C. A. PATTON (*Ohio Sta. Bul. 352 (1921), pp. 261–354, figs. 63*).—Data for temperature, rainfall, snowfall, evaporation, wind, and frostless periods at Wooster, and on temperature and precipitation for the district and county experiment farms and for the entire State during 1920 and preceding years are recorded and summarized in tables and diagrammatic maps.

The mean temperature for the year at the station was 49.2° F.; for the State 50.3°. The highest temperature at the station was 93°, June 10; for the State 98° June 10. The lowest temperature at the station was –5°, January 5; for the State, –11°, January 25. The annual rainfall at the station was 39.7 in.; for the State, 37.49. The number of rainy days at the station was 136; for the State, 117. The prevailing direction of the wind was southwest at the station and in the State at large. The length of the frostless period during 1920 at Wooster was 130 days, May 16 to October 7. The total evaporation at Wooster, May to October, 1920, was approximately 24.8 in.

“The years 1919 and 1920 were, in several respects, very much alike in that both were characterized by a large amount of fine, open weather and in the main were quite free from hurtful extremes.”

SOILS—FERTILIZERS.

Practical soil knowledge, A. NOWACKI (*Praktische Bodenkunde*. Berlin: Paul Parey, 1920, 7. rev. ed., pp. 208, pl. 1, figs. 12).—This is a popular handbook dealing with the investigation, distribution, and description of soils. It contains chapters on the nature and origin of the ground and soils, the shape of the soil surface, stratification in soils, and soil constituents and soil types. Under soil types are discussed stony, sandy, loamy, clayey marly, limy, and humus soil types.

Guide to soil experiment fields (*Missouri Sta. Guide*, 1 (1921), pp. 12, pl. 1, figs. 2).—Brief descriptions are given of the soil experiment fields at the station, together with some of the general results so far obtained. These have been noted from time to time from the bulletins and annual reports of the station.

Manual of the principal soils of Missouri, M. F. MILLER and H. H. KRUSEKOPF (*Missouri Sta. [Pamphlet]*, 1921, pp. 15, fig. 1).—This manual briefly describes the important soil areas of Missouri, and has been prepared to accompany a general map covering the soils of the State which was published in 1918 (E. S. R., 39, p. 813).

Soil survey of northern Wisconsin, A. R. WHITSON, T. J. DUNNEWALD, and C. THOMPSON (*Wis. Geol. and Nat. Hist. Survey Bul.* 55 (1921), pp. [4]+46, pls. 5, figs. 2).—This survey, made in cooperation with the Wisconsin Experiment Station, deals with the soils of an area of about 18,500,000 acres in upper Wisconsin. It is stated that nearly one-half of the area is already occupied by farms in all stages of development, and that more than 8,500,000 acres of good farm land are left, as well as 2,000,000 acres suitable only for pasture or forestry purposes.

There are considerable areas of level lands in northern Wisconsin, although for the most part the country is said to be rolling and in some sections is very rough and broken. Most of the soils have good natural drainage, but some have poor underdrainage and there are considerable areas of marshes.

There are ten principal soil types in upper Wisconsin, including sands, light sandy loams, heavy sandy loams, silt loams with well-drained subsoils, silt loam with a heavy subsoil, silt loam on limestone, heavy red clay, poorly drained soils, peat and muck, and rough and very stony lands. The heavy sandy loam is the most common soil and is considered the most valuable type in upper Wisconsin.

Report of the soil survey of the Diahlah area—right bank, J. F. WEBSTER and B. VISWANATH (*Mesopotamia Dept. Agr. Mem.* 2 (1921), pp. 20, figs. 6).—This survey deals with an area of about 400,000 acres lying between the Tigris and Diahlah Rivers, from Deltawah on the north to the junction of the rivers on the south, in Asiatic Turkey. The area is a slightly undulating plain with a general slope to the southwest.

The portion of the area under cultivation is almost entirely under irrigation by means of canals, and it is stated that no one of the canals is provided with any artificial system of drainage. Apparently considerable of the area is desert. It is stated that the river waters used for irrigation have a dangerously high soluble salt content for such arid soils.

The soil consists mainly of a calcareous alluvium, which is lighter in texture near the rivers. This alluvial soil is a gray to a gray-brown, fine-grained, porous, and friable soil, and is said to be similar to the adobe soils in other arid regions of the world. The subsoil is practically the same as the surface soil and extends to a depth of many feet.

Mechanical analyses of the soils indicate that they gradually increase in heaviness from west to east and very slightly so from north to south. The cultivated

soils tend to be heavier than the desert soils. In general the physical condition of the soil is said to be good, and permits of sufficiently high water capacity without prejudicing its facilities for good drainage.

Chemical analyses showed that the water-soluble salts in the soils consist of the sulphates and chlorids of calcium, magnesium, and sodium and the carbonate of calcium. Sodium carbonate was not found and, with a few exceptions, the quantities of individual and total salts found are considered to be less than the amounts which exert a decidedly harmful effect on crops. It was also found that where there are accumulations of clay, comparatively more salt is present. The salt content of cultivated areas is greater than that of uncultivated areas. The unirrigated tracts showed no appreciable quantities of soluble salts.

It was further found that nearly 50 per cent of the soil is soluble in hydrochloric acid and consists largely of calcium and magnesium carbonates. The calcium carbonate content ranges from about 12 to 29 per cent. The phosphoric acid content is apparently very evenly distributed and is considered to be sufficient for immediate needs. The potash content corresponds somewhat with the distribution of the clay, and is more abundant in the cultivated than in the uncultivated soils. Comparatively large quantities of the total potash are in available form. In general, the nitrogen content of the soils of the area is low.

Alkali lands in Iraq: A preliminary investigation, J. F. WEBSTER (*Mesopotamia Dept. Agr. Mem. 1* (1921), pp. 27).—A preliminary investigation on the alkali lands of Iraq, which is a distinctly arid region in Asiatic Turkey, is reported.

Iraq is a vast alluvial plain, having only very limited areas possessing a natural drainage. The annual rainfall is only about 5 in., and all cultivation is done under irrigation. Analyses of the soils show that the most commonly occurring salts are the chlorids and sulphates of sodium, calcium, and magnesium. Sodium carbonate has so far not been encountered. The alkali condition of these soils is attributed to imperfect drainage, excessive evaporation, seepage from irrigation canals, and irrigation with salty water.

Studies of the water used for irrigation showed that it contains at least 50 parts of salts per 100,000 parts of water. Land under intensive winter and summer cultivation receives as much as 70 in. of irrigation water, which results in an annual addition of 8,000 lbs. of salts per acre.

Pot culture experiments and field trials have shown that for the salts most usually occurring in this country 0.3 per cent of water-soluble solids may be regarded as distinctly harmful and any amount over 1 per cent as likely to inhibit growth.

It is concluded that the most obvious remedy for the situation at present is to grow alkali-resistant crops. Prevention of excess evaporation by mulching and furrow irrigation is another remedy which has proved profitable, particularly in gardens. A further method of treatment is to plow under the surface layer of the soil to a depth of at least a foot. This is specially effective when combined with heavy preliminary irrigations. Washing the salt into the subsoil by very heavy irrigations has also been practiced with some success on large areas in Iraq situated well away from the rivers. Underdrainage combined with leaching is considered to be the final and universal remedy for the reclamation of the soils of the area.

The "alkali" content of soils as related to crop growth, F. T. SHUTT and A. H. BURWASH (*Roy. Soc. Canada Proc. and Trans., 3. ser., 14* (1920), *Sect. III, pp. 57-70, figs. 12*).—In a further contribution to the subject (*E. S. R., 45, p. 116*), it was found that the alkali in irrigated dark clay loam soils growing wheat consisted chiefly of sodium sulphate. Sodium carbonate was present

in small percentages where the growth was from fair to good, and both magnesium and calcium sulphates were found where the growth was very poor. On rich, dark loam soil growing oats, the alkali was mainly sodium sulphate, varying in amount from 0.1 per cent in the region characterized by good growth to 0.9 per cent on the poor areas and 2 per cent on the bare spots. Magnesium sulphate was found, but in very small quantities, and the soil throughout the series was quite free of sodium carbonate and chlorids.

On rich dark loam soil growing timothy the alkali consisted of sodium sulphate and a trace of sodium carbonate. On the bare spots, however, calcium and sodium sulphates predominated, and magnesium sulphate was present in appreciable amounts. Where the growth was poor and on the bare spots, the higher concentrations of alkali were near the surface. On a dark brown loam soil well supplied with vegetable matter and growing vetch and rye, sodium carbonate was present where the growth was from fair to good, where the growth was poor, and on the bare spots, but not in sufficient quantities to be injurious. Sodium sulphate was the chief alkali where there was no growth.

It is concluded tentatively that 0.25 per cent of sodium carbonate marks an extreme limit for vetch and rye. The opinion is expressed that more investigational work will be necessary before final conclusions can be drawn as to the safe limits of alkali content of soil.

The views of soil ferment up to the present time, F. KEDING (*Mitt. Deut. Landw. Gesell.*, 36 (1921), No. 41, pp. 594-598).—A summary of the different conceptions of the so-called soil ferment from the beginning of history to the present time is presented, it being concluded that soil ferment may be defined as the product of the activity of nature, atmosphere, soil colloids, and soil microorganisms.

Preliminary note on the microbiology of the soil and the possible existence therein of invisible germs, G. ROSSI (*Soil Sci.*, 12 (1921), No. 5, pp. 409-412).—Studies conducted at the Royal College of Agriculture at Portici, Italy, to determine the possible presence of an invisible or ultramicroscopic flora in soil are reported.

This work was undertaken in view of the inadequacy of the recognizable microbic flora in the soil to explain many biochemical phenomena. The method used consisted of taking fresh soil, mixing it with ordinary water in equal weights and allowing it to decant for 30 minutes, and filtering the decanted liquid with porous candles by means of the Gay-Lussac pump in the Chamberland apparatus. The purpose was for the liquid containing the supposed invisible germs to descend aseptically into flasks containing culture liquids. The principal reactions that are attributed to invisible germs, namely, putrefactive reactions, nitrification, and nitrogen fixation, were observed.

It was found that the filtered infusion of soil did not contain indol but did contain ammonia and nitrites. The results were negative in an attempt to produce indol from the nutritive liquid containing peptone. The same liquid unfiltered produced it abundantly as a result of the ordinary agents of putrefaction. The sterile circulating solution did not cause any increase in nitrites beyond the amount which is naturally present in a nutritive solution. The experiments were carried even further, but the results obtained are concluded to be clearly insufficient to disprove the presence of invisible germs.

The studies are being continued.

The influence of green plants upon the oxidizing flora of the soil (*New Jersey Stas. Rpt.* 1920, p. 19).—Using the evolution of carbon dioxide from the soil as an index, it has apparently been demonstrated that a symbiotic relationship exists between growing green plants and the oxidizing flora of the soil.

Symbiotic nitrogen fixation by leguminous plants, with special reference to the bacteria concerned, R. HANSEN (*Sci. Agr.*, 1 (1921), No. 2, pp. 59-62, figs. 6).—In a contribution from the soils department of the University of Saskatchewan, data are reported from studies on nitrogen fixation by legumes which showed that leguminous plants when inoculated by the proper bacteria, as evidenced by the presence of nodules on the roots, are able to utilize the nitrogen of the air. This symbiotic relation exists only in the legume family, and was not found to occur in any nonleguminous plant either naturally or otherwise. No species of legume was found to exist which does not possess this relation provided the proper bacteria are present.

Leguminous plants are divided into groups according to the manner in which they can be cross inoculated by certain bacteria. These bacteria have become adapted to certain plants or groups of plants, and these adaptations which occur naturally are persistent and could not be broken down by repeated trial. These special adaptations could not be explained on the basis of close botanical relationship or soil reaction. The cultivation of the bacteria in various kinds of media through long periods of time did not destroy their virulence.

The continuous growing of corn with a legume and a nonlegume green manure crop, 1919, J. G. LIPMAN and A. W. BLAIR (*New Jersey Stat. Rpt.* 1920, pp. 376-380).—In the twelfth report of this series it was found that in the continuous growing of corn with a legume green manure crop (a mixture of vetch and red and white sweet clover) compared with a nonlegume (rye), small applications of manure being used on each for the introduction of decay organisms, the legume section gave a larger yield of grain with a higher percentage of nitrogen than the nonlegume section. The average yield of dry shelled corn on the legume section was about 13 bu. more than the average yield on the nonlegume section. The average percentage of nitrogen in the grain from the two sections was 1.49 for the legume and 1.21 for the nonlegume.

The total nitrogen recovered through the crop from the legume section was 54 lbs. per acre and from the nonlegume section 32 lbs. With reference to the manure treatment the treated plats of the legume section gave an average increase over the check plat of 4.4 bu. of grain, whereas the corresponding increase for the nonlegume section was only 0.7 bu.

The continuous growing of wheat and rye with and without a legume as a green manure, 1919, J. G. LIPMAN and A. W. BLAIR (*New Jersey Stat. Rpt.* 1920, pp. 380-382, fig. 1).—In the twelfth contribution to the subject (E. S. R., 44, p. 321), it was found in 1919 that the yields on the legume-treated (soy bean) plats were distinctly higher than on the nonlegume plats for both wheat and rye. The former showed an increase of over 3 bu. per acre and the latter an increase of over 5 bu. per acre. There was also a substantial increase of straw in both cases. There was little difference between the nitrogen content of the dry grain from the legume plat and that from the nonlegume plat, but the total nitrogen from the legume wheat plat was about 10 lbs. per acre more than that from the nonlegume plat.

Nitrification in some South African soils, T. D. HALL (*Soil Sci.*, 12 (1921), No. 4, pp. 301-363, figs. 10).—In a contribution from the School of Agriculture and Experiment Station at Potchefstroom, South Africa, a considerable amount of quantitative data on nitrification and related matters in certain South African soils is presented.

Preliminary studies were made to obtain an idea of the amount of nitric nitrogen in the soil on various portions of the station farm. Two samples of soil from a dry-land virgin plat showed nitrates in small quantity but in

very close agreement. During a cold month the nitrates increased from 0.48 to 2.9 parts per million. Soil from a cultivated irrigated plat contained only 0.44 part per million of nitrate, while that on dry-land cultivated plats contained from 18 to 38 parts per million. The dry-land virgin soil showed a rise in nitrate content at the height of the rainy season, when all other plats showed a large decrease. On dry-land potato plats there did not appear to be any definite inverse relationship between the nitrates present and the crop yields. The nature of the fertilizers used did not appear to have affected the subsequent nitrate content.

Studies of seasonal variation were also conducted.

Studies of the nitrifying power of two soils, one a virgin soil and the other cultivated and irrigated for 14 years, showed that in the first period of 29 days the virgin soil was slightly ahead of the cultivated soil where both were untreated and where lime was applied. Where blood meal was applied, the cultivated soil showed superior powers of nitrification. During the next three months the temperature steadily increased and the nitrates in the virgin soil were almost without exception ahead of those in the cultivated soil. This superiority was maintained through a further 8.5 months. The maximum amount of nitric nitrogen obtained in virgin controls corresponded closely to the maximum obtained in the fallow land of the same soil type in the field.

A study of the influence of temperature on nitrification led to the conclusion that the actual winter temperatures of July and August in South Africa were not sufficient to stop nitrification, while the soil moisture was adequate. It is concluded that nitrification is kept in check, in cold dry winters more by lack of moisture than by actual cold.

As regards the nitrification of cowpeas when used as a green manure on brown sandy loam soil, under the climatic conditions of South Africa green cowpea hay when turned under in a moist soil decomposed within two weeks, especially if the operation was followed by good rains. While rainfall apparently brings about very quick and complete decomposition of the green manure, everything points to the fact that the valuable decomposition products are carried below the first foot of soil. Results obtained with slaked lime and ground limestone on a slightly alkaline soil indicated the superiority of the latter. The turning under of green cowpea hay and either form of lime together did not increase the amount of nitric nitrogen except in one case.

A study of the effect of lime in the forms of calcium carbonate and slaked lime on nitrate production in nonirrigated land showed that neither kind of lime in varying amounts improved nitrification in a newly cultivated and slightly acid virgin soil. Aeration appeared to be a much more important factor than lime for this soil.

Studies of the amounts of nitrates in the first 5 ft. of the soils at the station showed that a nonirrigated soil contained more nitrate than an irrigated cultivated soil of the same type, although the latter soil did not receive sufficient water to carry the nitrates to the fourth foot. The virgin soil showed very little nitrate in the surface 12 in., and none was recorded below this depth. Soil supporting a maize crop 6.5 ft. high, following cowpeas cut for hay, showed as good a nitrate content for 5 ft. as the same soil when bare fallowed during the time. While the nitrates decreased 75 per cent at the surface foot during a very active growing period of the maize, they increased at the 5-ft. depth. The decrease in the surface foot is attributed chiefly to heavy rainfall. Land bare fallowed and land on which maize followed cowpeas cut for hay had better nitrate contents than the same land where maize followed maize.

Studies of the nitrifying power at different depths of soil growing maize following maize showed that there was hardly any nitrification below the second foot. The addition of nitrogenous fertilizers to the third, fourth, and fifth-foot samples depressed nitrification. There was a gradual decrease in the total nitrogen content of the soil from the first to the fourth foot. The loss on ignition, on the other hand, showed an increase with depth which did not correspond with the decrease in total nitrogen, but did correspond with the increase in hygroscopic moisture.

In a study of the nitrification of whale manure, including ordinary whale guano, ether-extracted whale guano, and sulphated whale guano, the sulphated guano was best nitrified in two out of three soils, both of which were slightly acid. Although the sulphating process renders a small amount of phosphate water soluble and sometimes gives a more nitrifiable product, it is considered of doubtful advisability, since it causes a loss of nearly 5 per cent of total nitrogen. The 14.9 per cent of material which can be extracted from ordinary whale guano by ether did not appear to suppress nitrification.

A comparative study of the nitrifiability on black clay loam and brown sandy loam of ten nitrogenous fertilizers, including ordinary whale guano, ether-extracted and sulphated whale guano, calcium cyanamid, crayferine, dried blood, bone meal, ammonium sulphate, dried cowpea hay, and sewage soil, showed that all the fertilizers with two exceptions were well nitrified. The crayferine was best nitrified in all cases, followed in order by ammonium sulphate, ordinary whale guano, cowpea hay, bone meal, dried blood, ether-extracted whale guano, and sulphated whale guano. With the exception of the sulphated whale guano, the fertilizers were much better nitrified in the alkaline black clay loam than in the slightly acid brown sandy loam. The soil nitrogen in the lighter type, however, was much more efficiently nitrified than that in the heavier type. In 62.5 per cent of the cases smaller amounts of nitrogen were more efficiently nitrified than larger amounts. These results are taken to indicate the advisability of using smaller quantities of material for nitrification studies.

In a study of the nitrifying powers of 54 different South African soils, it was found that the results obtained were in all cases smaller than those obtained by investigators in different parts of the United States. This is taken to indicate that nitrification in South African soils is not so intense as has heretofore been supposed. Dried blood in small quantities was the most efficiently nitrified, followed in order by ammonium sulphate, bone meal, and dried cowpea hay. With the virgin soils bone meal was best nitrified, followed in order by ammonium sulphate, dried blood, and dried cowpea hay. Nitrification in cultivated soils was in general superior to that in virgin soils. No relationship could be established between the efficiency with which the soil nitrogen was transformed to nitrate and the organic matter, nitrogen, and hygroscopic moisture contents of the soil or the rainfall of the area from which the soil came. There seemed to be a perceptible relationship in some cases at least between the amount of nitrate produced from soil nitrogen and the Veitch lime requirement of the soil.

It is concluded in general from all these experiments that nitrification in South African soils when compared with that in soils from any other parts is not exceptionally active, although it is good when compared with data from some sources. These results are also considered to add further evidence to show that nitrification is not so intense in the soils of arid and semiarid regions, or is not always superior to that in the soils of humid areas. However, it is concluded that nitrification seems quite adequate for the average crop

production, and that where the maximum rainfall and temperature coincide there is a maximum nitrification at the time of the greatest crop growth.

The influence of fertilization and plant growth on the sedimentation curve for water and soil mixtures, C. VON SEELHORST, W. GEILMANN, and H. HÜBENTHAL (*Jour. Landw.*, 69 (1921), No. 1, pp. 5-32, figs. 2).—Studies on the influence of fertilization and plant growth on the results of sedimentation analyses and electrical conductivity measurements of the water solution of soils from the experimental fields at the University of Göttingen are reported.

The field was divided into nine plats on which rye, horse beans, winter wheat, beets, barley, potatoes, spring wheat, peas, and kidney beans were grown. Each plat was divided into eight parcels, which were fertilized with nitrogen, phosphoric acid, potash, and combinations thereof.

Sedimentation analyses of samples of soils taken in the spring showed the marked influence of nitrogen fertilization on speed of sedimentation. Phosphorus and potash had a somewhat less marked influence, but both increased the speed of sedimentation, especially the latter. The speed of sedimentation was the greatest where phosphorus and potash were used with nitrogen.

The results were somewhat different with soil samples taken in the fall. The longer sedimentation periods with soils planted to horse beans and winter wheat are attributed to the exhaustion of the soil in easily assimilable nutritive constituents by these crops. The soils planted to beets, barley, and kidney beans showed greater variations in sedimentation periods by samples from individual parcels, especially where beets were grown. An essential difference between the actions of the barley and kidney bean soils was noted, in that the former when fertilized with nitrogen showed a slower sedimentation speed than the soils not treated with nitrogen.

A comparison of the action of the spring and fall samples shows that the sedimentation of the fall samples of soils fertilized with nitrogen was slower than that of similar samples taken in the spring. This was also true in the majority of cases for the soils of the other parcels. The quantities of finest particles settled were greater in the fall than in the spring, with the exception of the barley soils fertilized with potash and the unfertilized beet, barley, and kidney-bean soils. The smallest quantity of finest particles was found in the soil solution from completely fertilized soils and the greatest quantity from unfertilized soils. A variation and general decrease in fine particles in soils was noted in the spring as compared to the fall, which is attributed to fertilization and the resulting flocculation of the soil. As the influence of fertilization is reduced through climatic, vegetable, biological, and cultural influences, an increase of fine particles in the fall naturally follows. It is concluded in general that the variations in the rate and amount of sedimentation of soils depend upon the quality and quantity of the water-soluble salts present.

In this connection studies of the electrical conductivity of water solutions of the soils in question and of the dry residues obtained therefrom are also reported. The results showed that the electrical conductivity increased with the percentage of dissolved salts in the soil solutions, and vice versa. In the spring the nitrogen fertilization increased the amount of dry residue from the soil solution and potash and phosphorus to a less extent. Potash and phosphorus, when used with nitrogen, caused a considerable increase in dry residue, with certain exceptions. The quantity of dry residue was in general much less in the fall than in the spring. A comparison of the quantity of the finest particles in the soil suspensions with the salt content of the solutions showed that the former decreases as the latter increases. It is concluded that the soil suspensions are a function of the content of soluble soil salts.

Some results from fertilizers on muck soils, M. M. McCool and P. M. HARMER (*Michigan Sta. Quart. Bul.* 4 (1921), No. 2, pp. 45-51, figs. 5).—The progress results of several cooperative experimental and demonstrational fertilizer projects conducted on muck soils with blue grass, sweet clover, sunflowers, corn, and sugar beets are reported and discussed.

These apparently indicate the general need for potash and phosphoric acid by these soils. While the former appears to be the limiting element, best results were obtained in most cases with a combination of the two fertilizers.

Farmyard manure in Egypt, J. A. PRESCOTT (*Sultan. Agr. Soc., Tech. Sect., Bul.* 8 (1921), pp. [1]+24, figs. 2).—Following an introductory note by V. M. Mosséri, four sets of experiments carried out during the seasons of 1918, 1919, and 1920 with maize are reported, showing that the value of Egyptian barnyard manure as a fertilizer is directly correlated with the amount of available nitrogen present as ammonia or as nitrate. It is noted that soil is normally used as the absorbent for animal excrements in the making of this manure. A simple method for the determination of available nitrogen is given and recommended for use in Egyptian laboratories.

It was further found that during storage under favorable moisture conditions all the ammonia present is changed into nitrate, but that there is no increase in the available nitrogen of the manure. With an excess of water denitrification occurs, and with excessive aeration there is a loss of ammonia. It was impossible by any method of storage for six months to convert appreciable quantities of original organic nitrogen into an available form, and it is considered that the question of making this organic nitrogen available by suitable storage conditions is the main problem to be solved in connection with Egyptian barnyard manure. In this connection it is recommended that Egyptian farmers store the manure in large compact heaps, well removed from any excess of water.

The manufacture of chemical manures, J. FRITSCH (*London: Scott, Greenwood & Son, 1920, 2. ed., rev. and enl., pp. XII+383, figs. 76*).—This is the second revised and enlarged English edition of this book (*E. S. R.*, 26, p. 124), prepared by H. B. Stocks.

The nitrogenous action of materials resulting from the conservation of liquid manure with formalin on plant growth, E. BLANCK and F. PREISS (*Jour. Landw.*, 69 (1921), No. 1, pp. 33-48, fig. 1).—Vegetation experiments with oats on sand soil to determine the influence on plant growth of substances formed by the treatment of liquid manure as sources of nitrogen are reported.

It was found that hexamethyltetramin had a marked influence on plant growth, which was more favorable in some cases than that of ammonium sulphate. On the other hand, urea-aldehyde and cyanoaldehyde preparations were entirely useless as sources of nitrogen. It is concluded that the chemical compositions of the two latter substances are too unstable and indefinite to warrant further study.

As a general result of this study it is concluded that hexamethyltetramin is the substance in liquid manure conserved with formalin which has a favorable influence upon plant production and nitrogen assimilation. The condensation product urea-aldehyde formed simultaneously has no such influence. These results are taken to indicate that the practical conservation of liquid manure with formalin takes place when the liquid manure is treated with formalin after the urea content of the former has become completely transformed into ammonia.

Inoculated legumes as nitrogenous fertilizers, P. E. BROWN and J. H. STALLINGS (*Soil Sci.*, 12 (1921), No. 5, pp. 365-407).—In a contribution from the Iowa State College, experiments with red clover and alfalfa on Carrington loam and Miami fine sandy loam soils are reported. In some cases the

legumes were grown on these soils without treatment, and in others the soils were sterilized and inoculated with cultures containing the proper bacteria to bring about inoculation.

It was found that on the average 36 per cent of the total plant growth of clover was in the roots at maturity on unsterilized soil. On sterilized soil the percentage was lower. A larger proportion of the total plant growth of clover was in the roots at maturity on the soil poorer in organic matter and nitrogen. On the better soil there was a greater total growth and a much greater growth of tops. Over one-half of the plant growth of the alfalfa was in the roots at maturity on the unsterilized Carrington loam and slightly less than one-half on the unsterilized Miami fine sandy loam. On the sterilized, inoculated Carrington loam the percentage was slightly lower. The percentage of total nitrogen in the roots of both clover and alfalfa was greater on the soil poorer in organic matter and nitrogen. On the average 27 per cent of the total plant nitrogen was in the roots of clover at maturity under natural soil conditions, while with alfalfa an average of 46 per cent of the total plant nitrogen was in the roots.

With clover there was a greater fixation of nitrogen on the poorer soil, while with alfalfa the greatest fixation was on the better soil. With clover on both soils unsterilized all of the nitrogen in the tops and some of that in the roots was found to come from the air. On the Miami fine sandy loam a larger proportion of the nitrogen in the roots came from the air than on the Carrington loam. With alfalfa all of the nitrogen in the tops and some of that in the roots came from the air.

It is concluded that when clover and alfalfa are grown and the hay crops removed there may be some gain in nitrogen in the soil, which will vary with the legume, the soil type, the inoculation, and the general conditions of growth.

The influence of the mechanical composition of the soil on the availability of nitrate of soda and dried blood, J. G. LIPMAN and A. W. BLAIR (*New Jersey Stas. Rpt. 1920, pp. 353-367, figs. 6*).—The results for the year 1919 of the series of cylinder experiments begun in 1911 (*E. S. R., 44, p. 322*) are reported.

When barley was grown on loam soil and on various dilutions of this loam with sand, sodium nitrate gave a larger yield of dry matter and a higher nitrogen recovery than an equivalent amount of dried blood in all cases except the all-sand series. The average recovery with nitrate for all series was 46.53 and for dried blood 33.38 per cent. The average recovery for the past five years with sodium nitrate was 55.3 and with dried blood 36.6 per cent.

Buckwheat grown as a residual crop recovered very little nitrogen from either sodium nitrate or dried blood. The average recoveries for the two crops combined for the year were sodium nitrate 47.34 and dried blood 37.58 per cent. The average combined recoveries for the past five years were sodium nitrate 57.02 and dried blood 49.6 per cent.

"With the soil under consideration, nitrate gives only a slight residual recovery of nitrogen, but its initial effect, that is the effect on the first crop, is sufficiently above the initial effect of dried blood to give it a higher standing than the latter, when the results for the two crops are combined."

Sulphate of ammonia as a nitrogenous fertilizer, G. H. AULL (*Amer. Fert., 55 (1921), No. 11, pp. 74, 76, 78, 82, 84, 86, 88, figs. 3*).—In a contribution from the South Carolina Experiment Station, experiments are reported in which ammonium sulphate was compared with sodium nitrate and cottonseed meal when used in complete fertilizers as a source of nitrogen. It was found that the ammonium sulphate gave better results on cotton, oats, and peavine hay than

either of the other two materials. This is attributed to the superior value of ammonium sulphate in a mixed fertilizer.

In further experiments on the use of ammonium sulphate as a top-dressing as compared with dried blood and sodium nitrate, it was found that the yield of peavine hay was the same in the case of sodium nitrate and ammonium sulphate as it was when no top-dressing was used, and that there was no gain from the use of dried blood. Greater increases in the yields of corn and cotton were obtained from ammonium sulphate as a top-dressing than with the use of the other fertilizers. It is concluded that ammonium sulphate is superior to both sodium nitrate and dried blood as a top-dressing and when used in a mixed fertilizer for the crops mentioned.

Sulphate of ammonia as a fertilizer, R. D. ANSTEAD (*Planters' Chron.*, 16 (1921), No. 42, pp. 688-691).—Experiments on the use of sulphate of ammonia as a fertilizer on South Indian soils for such crops as wheat and barley are reported, leading to the conclusion that nitrogenous fertilizers which undergo a rapid nitrification materially increase the lime requirement of these soils.

Some further factors influencing the solubility of phosphoric acid in mixed fertilizers containing superphosphates, E. V. FLACK (*So. African Jour. Sci.*, 17 (1921), No. 3-4, pp. 268-274).—Continuing work previously noted (E. S. R., 38, p. 519), studies are reported to determine the influence of mixing superphosphate with Ephos basic phosphate, Saldanha Bay phosphate, ground limestone, krall manure ash, seaweed ash, and bush or plant ash on the solubility of the phosphoric acid of the superphosphate.

It was found that the greatest loss of water-soluble phosphoric acid occurred in the limestone mixture. Chemical action started immediately and was continuous. After being mixed for three weeks the loss amounted to as much as 98 per cent. The loss in reversion with mixtures of superphosphate and ashes varied from 52 to over 84 per cent, and was obtained during a period of three weeks. The least reversion occurred with the ash from sea plants and the highest with the plant ash. This is attributed to the lower carbonate content of the ash of sea plants.

It is concluded that superphosphate should not be mixed with mineral phosphate, basic slag, Ephos basic phosphate, limestone, or ashes on account of the resulting rapid reversion of water-soluble phosphoric acid to forms insoluble in water. It is further concluded that a mixture of superphosphate and mineral phosphate can be made if the amount of lime combined as carbonate is low in the untreated phosphate.

The action of potash salts on the acid soils of Assam, P. H. CARPENTER and C. R. HARLER (*Indian Tea Assoc., Sci. Dept. Quart. Jour.*, 1921, No. 2, pp. 43-64, pls. 2).—Studies on the influence of potash salts when applied in large amounts to acid tea soils showed that these soils fixed potash and ammonia from their salts in a manner similar to that shown by the chalky soils of Great Britain. The reaction was found to be partly one of physical adsorption and partly one of chemical interchange of bases. The capability of the soil to interchange bases increased as the clay content of the soil increased. With weak salt solutions, comparable in strength with those met in the soil, and with strong solutions the predominating factor was physical adsorption. The bases iron and alumina, in addition to lime, magnesia, and potash, were found to be liberated by soluble salts of strong acids from soils poor in lime or alkalis.

With sandy soils the bases liberated corresponded with the equivalent bases fixed. This was not the case with heavy soils, for the salt as a whole appeared to be adsorbed. Soluble alumina was found to be toxic to the tea plant. The liberation of alumina by salts from soils is not considered to signify that the

soil is infertile. The presence of lime in the soil solution appeared to render alumina harmless. Toxic alumina was removed from the soil by the addition of superphosphate which precipitated the insoluble salt, by lime which rendered the oxid insoluble, or by potash which brought the alumina into solution as a salt which can easily be leached out of the soil. Superphosphate increased the chemical activity of the soils of Assam by increasing their capability of fixing bases.

It is concluded that, until the exact significance of soil acidity as met in Assam is defined, a solution of the problem on hand will not be found, and that drainage, soil aeration, and tilth are factors capable of so affecting the degree of hydration of certain soil constituents as to render them toxic and nontoxic.

Limestones and marls of North Carolina, G. F. LOUGHLIN, E. W. BERRY, and J. A. CUSHMAN (*N. C. Geol. and Econ. Survey Bul. 28 (1921), pp. 211, pls. 15, figs. 3*).—This report is in four parts. Part 1 gives general information on limestones and related materials. Part 2 deals with the limestones and dolomites, including marbles in western North Carolina. These are considered to be of much more present and future importance than the marls of the eastern part of the State, which are dealt with in part 3. Part 4 considers the economic importance of North Carolina in the marble, limestone, and lime industries from the standpoint of present production, and of the suitability of the resources for more extensive use in different industries which require the use of limestone or lime.

Lime and chalk, G. S. ROBERTSON (*Essex Agr. Com., East Anglian Inst. Agr., Chelmsford, Bul. 24 (1921), rev., pp. 16*).—This is a brief popular discussion of the subject, in which the pressing need for lime and chalk on Essex soils is given and certain experimental results obtained at the Rothamsted Experimental Station are presented. Information is also given on the purchase and use of lime. Analyses on a number of samples of soil from various parts of the county are presented, showing that these soils as a rule are very deficient in lime.

Use of various compounds of calcium on adobe soils of foothill regions of Tulare County, R. S. VAILE and G. SURRE (*Calif. Citrogr., 7 (1921), No. 1, pp. 3, 24, 26, 27, figs. 4*).—In a contribution from the California Experiment Station, data and information are presented to show that the adobe soils of the foothill regions of Tulare County are almost universally well supplied with calcium carbonate. There are said to be numerous and notable instances where it is present in such form and concentration as to be positively injurious to citrus trees. It is believed that the use of calcium carbonate to improve the texture of the soils of citrus groves in the region is unnecessary and may be actually injurious. It is considered possible, however, that the use of gypsum may be beneficial on these soils.

Investigation on the injurious action of soda lime and borax lime, O. LEMMERMANN and H. WIESSMANN (*Landw. Jahrb., 55 (1920), No. 2, pp. 277-280*).—Studies are reported on the influence on winter rye and potatoes of by-product lime containing borax and a soda lime on a weak sandy loam soil as compared with lime marl. Neither soda lime nor borax lime injured the plants. Pure lime marl increased the average yield, soda lime decreased the yield, and borax lime had no influence, stimulating or otherwise.

Fertilizer experiments with magnesium sulphate, O. LEMMERMANN and H. WIESSMANN (*Landw. Jahrb., 55 (1920), No. 2, pp. 273-276*).—Experiments to determine the influence of magnesium sulphate on winter rye and summer barley on a soil containing 0.115 per cent of magnesium oxid and 0.082 per cent of calcium oxid are reported. The magnesium sulphate was applied at the rate of 400 kg. per hectare (356 lbs. per acre). It was found that such excessive

fertilization with magnesium sulphate had no influence on the yield of the two grain crops.

Fertilizer experiments with iron sulphate, H. WIESSMANN (*Landw. Jahrb.*, 55 (1920), No. 2, pp. 281-286).—Experiments are reported to determine the influence of iron sulphate on winter rye and summer barley on weak loamy sand soil. It was found that the iron sulphate had no favorable influence on the crops and in some cases decreased the yield. No catalytic effect of the iron sulphate was observed.

Report on commercial fertilizers, 1921, E. H. JENKINS and E. M. BAILEY (*Connecticut State Sta. Bul.* 233 (1921), pp. 21-109).—This bulletin contains a list of brands of commercial fertilizers registered for sale in Connecticut during 1921, and presents the results of actual and guaranteed analyses and valuations of 636 samples of fertilizers and fertilizer materials, representing 544 brands, collected for inspection in the State during the year.

Analyses of insecticides and fungicides are appended.

Commercial fertilizers, S. H. WILSON (*Ga. Dept. Agr. [Quart.] Bul.* 87 (1921), pp. 136).—This report presents the text of the Georgia fertilizer laws and results of actual and guaranteed analyses and commercial valuations of 2,611 special and regular samples of fertilizers and fertilizer materials, offered for sale in Georgia and collected from September 1, 1920, to September 1, 1921.

Fertilizer control, J. L. HILLS, C. H. JONES, ET AL. (*Vermont Sta. Bul.* 223 (1921), pp. 3-12).—This section of this bulletin consists of a summary of the actual and guaranteed analyses of 521 samples of fertilizers and fertilizer materials, representing 137 brands, collected for inspection in Vermont during 1921.

Proceedings of the twenty-eighth annual convention of the National Fertilizer Association (*Natl. Fert. Assoc. Proc.*, 28 (1921), pp. 134).—These proceedings contain, among other things, special articles on Railway Rates as They Affect the Fertilizer Industry, by J. W. White; Alsatian Potash; Higher Analysis Formulas; Economic Factors in Higher Analysis Formulas, by L. W. Rowell; Relations of the Fertilizer Industry and Experiment Stations, by G. Ober, jr.; Some Tendencies in Soil Fertility Thought and Research, by W. D. Hurd; and Economic Fallacy of Muscle Shoals Project, by G. Ober, jr.

AGRICULTURAL BOTANY.

Plant families: A plea for an international sequence, A. GUNDERSEN (*New Phytol.*, 19 (1920), No. 9-10, pp. 264-271).—In view of the variety of systems and modifications of systems of plant classifications that have been proposed, the need of constant revision, of stability, and of an ideal (future) system showing the course of plant evolution, the author suggests the idea of a periodic inventory of facts and opinions apparently bearing on the sequence of families, especially of living vascular plants. Where facts are not conclusive, a truly international agreement should be sought. Standard numbers revised at intervals would serve important practical purposes. Discussion is suggested.

Note on a numerical sequence of plant families, M. BENSON (*New Phytol.*, 20 (1921), No. 2, pp. 90, 91).—This is a response to the suggestion by Gundersen, in his paper above noted, offering suggestions regarding the plan proposed.

The biochemistry of carbohydrate production in the higher plants from the point of view of systematic relationship, F. F. BLACKMAN (*New Phytol.*, 20 (1921), No. 1, pp. 2-9).—The purpose of this paper is to review some of the biochemical diversities of carbohydrate production which occur characteristically in certain groups of plants classed as systematically related, and to study such diversities regarded as steps toward a biochemical classification of plants

and their rank in relation with morphological characters on which groupings of flowering plants have been based in the past.

The facts dealt with, selected mainly from the literature of research and discussion, are considered first as related to the spontaneous changes undergone by sugars in the presence of impurities, to the great variation in the sugar-to-polysaccharid transformation through the range of flowering plants, and to the conceivable attainability of a biochemical classification of plants.

Stomata and hydathodes in *Campanula rotundifolia* and their relation to environment. M. W. REA (*New Phytol.*, 20 (1921), No. 2, pp. 56-72, figs. 6).—The author finds that the number of stomata per square millimeter varies in *C. rotundifolia*, increasing especially on the upper surface with a higher position of the leaf on the shoot, and on the under surface also with increase of illumination and dryness of the habitat of the plant. The increase in the sun shoot as compared with the normal shoot is possibly due to increased photosynthesis involving the utilization of more carbon dioxide, the water loss at the same time being lessened by a reduction in the number of hydathodes and by the more nearly erect position of the leaf. The arrangement of the stomata varies according to the leaf surface. The stomata on the under surfaces varied markedly in size for the lower leaves of the normal and shade shoots.

Hydathode groups were present on the upper surfaces of all the leaves examined, being more numerous toward the bases of the shoots, an apical group only being present on the upper linear leaves.

From the data obtained it is concluded that hydathodes are developed to a degree which is dependent upon the development of the vascular system of the individual leaves, upon the position of the leaves on the shoot, and also upon the habitat of the plants.

What is the significance of the efficiency index of plant growth? F. KIDD, C. WEST, and G. E. BRIGGS (*New Phytol.*, 19 (1920), No. 3-4, pp. 88-96, figs. 2).—Although two of the present authors have in a previous communication (E. S. R., 43, p. 224) put forward a conception of plant growth as progressing in a way analogous to the working of a compound-interest scheme, they are now convinced that a more complete analysis of existing data on plant growth would not warrant so rigid an application, throughout the whole life history of a plant, of the conception made by Blackman (E. S. R., 43, p. 29) and adopted and applied by Brenchley (E. S. R., 44, p. 630).

The value said to be regarded by Blackman as a physical constant and as an index of efficiency is not really constant at all in the plants that have been investigated. This index, it is claimed, is of no value in comparing the efficiency of different plants, except over strictly comparable times and phases of development, so that the application of the formula by Brenchley in comparing plants of different degrees of maturity is not considered valid.

The significance of the efficiency index of plant growth. V. H. BLACKMAN (*New Phytol.*, 19 (1920), No. 3-4, pp. 97-100).—Replying to criticisms in the contribution above noted, the author argues that fluctuations in the efficiency of the plant do not affect the value of the efficiency index, since all that the calculation gives is the average efficiency index. The analogy with a physical constant should not, it is held, be pressed very closely. Other statements are noted and discussed.

Methods and significant relations in the quantitative analysis of plant growth. C. WEST, G. E. BRIGGS, and F. KIDD (*New Phytol.*, 19 (1920), No. 7-8, pp. 200-207).—The authors are conducting a comprehensive study of the growth of *Helianthus*, and are publishing the results they have gathered from an analysis of the data given out by Kreuzler and his coworkers during 1875 to

1885. Some results of the present study have been noted previously (E. S. R., 45, p. 525).

The present paper is mainly an account with discussion of attempts to express plant growth in units which are significant and usable, in which respect and for which purpose increase in dry weight is considered suitable for adoption as the best measure of plant growth. Suggestions are given regarding formal methods of assembling secondary data on what are thought to be the most profitable lines as a result of the closest inspection which is possible at the present time.

Mutations and evolution, R. R. GATES (*New Phytol.*, 19 (1920), Nos. 1-2, pp. 26-34; 3-4, pp. 64-88; 5-6, pp. 132-151, figs. 2; 7-8, pp. 172-188; 9-10, pp. 213-253).—The general character and scope of this contribution are shown by the headings of the principal chapters, which deal with historical concepts and their developments, foundations of the mutation concept, forms having an extra chromosome, nondisjunction in *Drosophila*, parallel mutations, presumptive mutations in wild and cultivated plants, mutations in animals, limitations of the cell theory, the recapitulation theory, inheritance of acquired characters, general comparison of recapitulatory and karyogenetic characters, and orthogenetic characters. An extensive bibliography is given, citing related literature appearing as early as 1894 and as late as 1920. Facts and views are cited in their bearing upon inheritance characters, both original and acquired, and upon other influences presumably or possibly operative in determining the presence or absence of characters in successive generations of plants or of animals.

Mutations and anomalies [in plants], E. GUYÉNOT (*Rev. Sci. [Paris]*, 59 (1921), No. 21, pp. 611-617).—This is a discussion of forms and features of mutation, as opposed to other forms of modification in posterity, occurring in plants or animals.

Thalasssiophyta and the subaerial transmigration, A. H. CHURCH (*Bot. Mem. [Oxford Univ.]*, No. 3 (1919), pp. 95).—The scope and character of this contribution are indicated by the headings of the several sections, which respectively deal with the origin of land flora and the so-called antithetic alternation; the hypothetical landward migration; the origin of the archegonium; the possibility of direct progression from the sea; the culmination of marine phytobenthon; the mark of the transmigrant; what probably happened [characterizing emergence]; the triple sequence, plankton, benthon, xerophyton; the story of the survivors (Thallophyta); Bryophyta; Pteridophyta; and the algae of the transmigration.

Thalasssiophyta and the algal ancestry of the higher plants, F. E. FRITSCH (*New Phytol.*, 20 (1921), No. 4, pp. 165-178).—This is chiefly a critical discussion of the two main aspects of the origin of land plants according to the views of Church as above noted, first, that plants were left stranded by lowering sea surfaces instead of being enabled or aided by tides to invade the mouths of fresh-water coastal indentations, and secondly that the first land plants originated, not from simple filamentous algae, but from rather bulky seaweeds. The conditions postulated by Church are questioned, and other supposed possibilities are indicated.

The evolution of plants, A. G. TANSLEY (*New Phytol.*, 19 (1920), No. 1-2, pp. 1-10).—A critical review is given of the contribution by Church, above noted, outlining some of the main features of the history of plant life and its development under changing conditions as conceived by that author.

The evolution of primitive plants from the geologist's viewpoint, C. SCHUCHERT (*New Phytol.*, 19 (1920), No. 9-10, pp. 272-275).—Referring to the review by Tansley above noted, of the views presented by Church, the author

offers criticisms of geologic data in Church's contribution regarding the evolution of primitive plants.

The influence of varying degrees of soil moisture upon the physiological salt balance for plants, J. W. SHIVE (*New Jersey Stas. Rpt. 1920, pp. 387-395*).—Some results are given of an experimental study of the influence of different degrees of moisture in soil cultures upon the balance of salt proportions as affecting the growth of plants. Buckwheat was grown in soil cultures which received 21 different proportions of potassium phosphate, calcium nitrate, and magnesium sulphate. The moisture content of the soil of the different series was brought to 30, 60, and 80 per cent of their moisture-retaining capacity. The dry weight of the different plants was determined for the different series at the beginning of the flowering period.

It was found that a complete fertilizer with the salt constituents well balanced for plant growth required approximately optimum moisture conditions of the soil to which it was applied in order to impart to it its maximum physiological value or plant-producing power. With a good salt balance for plant growth and approximately optimum soil moisture conditions, a medium fertilizer application had greater plant-producing power than a heavier application, with the moisture content of the soil to which it was applied either above or below the optimum for plant growth. It is believed that the actual physiological value or plant-producing power of any given set of fertilizer constituents is dependent to a very large degree upon the moisture conditions of the soil to which the fertilizer is applied.

Relation of the hydrogen-ion concentration of the soil to plant distribution, W. R. G. ATKINS (*Nature [London], 108 (1921), No. 2707, pp. 80, 81*).—The author sums up concisely data presented by Wherry in contributions dating as far back as 1916, some of which have been noted (*E. S. R.*, 40, p. 812; 44, pp. 418, 419; 45, p. 123).

The interrelation between plant growth and the acidity of nutrient solutions, E. VAN ALSTINE (*New Jersey Stas. Rpt. 1920, pp. 395-401*).—Studies are reported on the effect of the growing plant upon the reaction of the nutrient solution, and also the effect of the reaction of the nutrient solution upon the growth of plants. Plants of various kinds were grown in nutrient solutions and the changes in the media noted. Comparisons were made with plants grown in distilled water, and it was found that while the reaction of the distilled water was always brought near to an average figure, regardless of the solution in which the plants had been grown previously, the acidity of the nutrient solution was increased by some species and decreased by others.

In the second part of the investigation, the author sought to determine the degree of acidity that some common agricultural plants can withstand without injury. Soy beans and buckwheat were grown in culture solutions modified so as to have definite initial hydrogen-ion concentrations. The results obtained indicated that soy beans were not injured by an acidity of the nutrient solution corresponding to a pH value of 4.0, but can not withstand an acidity greater than this without injury, especially to the roots.

Iron was added to the culture media in the form of ferric phosphate and a study made of chlorosis. It was found that chlorosis was apparently due to the inability of the plants to obtain a sufficient amount of iron from the solutions with low acidity. Buckwheat was found to withstand, for at least 21 days, an acidity corresponding to a pH value of 3.3. A slight chlorosis was observed in the leaves of one plant growing in a solution having a pH value of 5.0. In a third series of cultures, in which plants were grown to maturity, marked injury appeared only in those cultures having pH values of 3.3 and 3.5. Chlorosis was slightly evident in plants growing in the solutions having a pH value of 4.1.

The author states that under the conditions of growth in this series the range of acidity through which plants were able to withstand the acidity satisfactorily and get sufficient amounts of iron to supply their needs was from about 3.7 to 4.1.

A study of the salt requirements of the potato, W. H. MARTIN and J. W. SHIVE (*New Jersey Stas. Rpt. 1920, pp. 409-412*).—A study was made to determine the salt combinations required for the maximum development of tubers, tops, and roots of the potato. Potatoes of the Green Mountain variety were grown in sand which received 21 different sets of salt proportions of potassium phosphate, calcium nitrate, and magnesium sulphate.

The six cultures which produced high yields of tubers showed a wide range in the proportions of potassium phosphate, indicating apparently that this salt may not be very definitely related to the production of high yields of tubers. The proportions of calcium nitrate and magnesium sulphate associated with high yields of tubers extend over relatively small ranges and are, therefore, well defined. On the whole, it appeared that the salt proportions which produced high yields of tops are more definitely defined than are those which produced high yields of tubers, and nearly all the cultures which produced low yields of tops and tubers were characterized by having high proportions of one of the three component salts and correspondingly low proportions of the other two.

The results given are considered only preliminary and not sufficient upon which to base definite conclusions.

The effect of ammonium sulphate upon the availability of iron in nutrient solutions, L. H. JONES (*New Jersey Stas. Rpt. 1920, pp. 405-409*).—Spring wheat was grown in water cultures in an attempt to substitute ammonium sulphate for potassium nitrate in Tottingham's nutrient solutions.

In the first experiment iron was added in the form of a semicolloidal suspension of ferric phosphate. At the end of the five-week period of growth the plants were harvested and the dry weights of tops and roots obtained from which it appeared that the five highest yields from the ammonium sulphate series were much superior to the corresponding yields from the Tottingham series. In the latter solutions a chlorotic condition of the plants was observed which indicated the inability of the plants to get sufficient iron for their needs from the insoluble ferric phosphate in the solutions. A study of the hydrogen-ion concentration showed that there was a tendency on the part of the Tottingham solutions to become less acid, while with the ammonium sulphate series the reverse was the case.

In the second experiment ferrous sulphate was added to the solutions in the different series, and the dry weight of the five highest yielding pots showed decided superiority for the Tottingham series, the results in this case being the reverse of the ones described above. No chlorosis was observed, and it appeared evident that given forms of iron in fixed small amounts are not equally efficient for plant growth.

The influence of green plants upon the oxidizing flora of the soil, J. R. NELLER (*New Jersey Stas. Rpt. 1920, pp. 401-404, pl. 1*).—A report is given of experiments conducted to determine the influence of growing plants upon soil biological processes. Soy beans and barley were grown in jars containing 2,000 gm. of soil, and since the carbon dioxid of the indrawn air was removed, the only source of that compound within the apparatus was from the decomposition of the organic matter in the soil. As there was an increased carbon dioxid recovery from the planted soil, it is considered that the growing plant had stimulated the oxidation processes in the soil, and that there

was an apparent symbiotic relationship between the plants and the microorganisms concerned with the oxidation of the organic matter in the soil. It is believed that the extra amount of available organic food which is supplied to the microorganisms by the growing plant may cause them to oxidize and mineralize more of the original supply of organic matter in the soil and make it available to the plant, resulting in increased plant growth.

A theory of geotropism: With some experiments on the chemical reversal of geotropic response in stem and root, J. SMALL (*New Phytol.*, 19 (1920), No. 3-4, pp. 49-63, pl. 1, figs. 5).—Certain theoretical considerations have led to the conclusion that the difference in the responses of the stem and the root under the stimulus of gravity depends upon the relative alkalinity of the continuous phase of the plasma membranes of the stem apex and the relative acidity of the corresponding medium in the root apex. The author has secured and arranged experimental evidence for this view and the theoretical considerations involved, these forming the substance of the present contribution.

Preliminary notes on additional evidence for the hydrion differentiation theory of geotropism, J. SMALL and M. W. REA (*New Phytol.*, 19 (1920), No. 7-8, pp. 208-212, figs. 3).—Since the publication of the theory of geotropism as above noted, considerable additional evidence in favor of the theory has been obtained, and is presented in preliminary form.

Briefly stated, the theory is that the differentiation in hydrion concentration in stem and root is caused by the comparatively slow escape of the carbon dioxide of respiration from the root, which thus becomes relatively acid, and the rapid elimination of that carbon dioxide from the stem and leaves, either by diffusion through the stomata or by its utilization in photosynthesis, or by both these methods. The shoot therefore becomes relatively alkaline, and the hydrion differentiation is in this way connected with the normal metabolism of the plant.

From this hypothesis it follows that when shoots are placed horizontally in the dark they may cease to react or may react in the reverse direction to the normal under geotropic stimulation. If these shoots are coated with vaseline the carbon dioxide of respiration should accumulate within them, and the geotropic response should be reversed. Shoots of a number of very different plants have been treated in this way, and the results are discussed in considerable detail, the present contribution being mainly an attempt to explain the underlying causes of the behavior of the plants used and apparent exceptions to the behavior expected.

Preliminary note on a hydrion differentiation theory of heliotropism, J. SMALL (*New Phytol.*, 19 (1920), No. 9-10, pp. 275, 276).—Further work having indicated that the carbon dioxide balance is of the fundamental importance, in connection with geotropism and heliotropism, suggested in the contribution noted above, a hydrion differentiation theory of heliotropism has been developed.

The present theory is that the direction of geotropic curvatures is also governed by the hydrion concentration of the continuous phase of the plasma membranes of the perceptive cells. Briefly, it is suggested that light, either by increasing photosynthesis and the amount of respirable material or more probably in some other way, increases the rate of respiration in the perceptive cells. This increase in respiration involves an increase in the carbon dioxide within the cells affected. Such an increase in carbon dioxide involves in root structures an increased hydrion concentration of the already relatively acid continuous phase of the plasma membranes, giving increased relative acidity with consequent increase in polarization and in turgidity. Root structures, therefore, become more turgid on the side which is more illuminated, and show negative heliotropism.

An explanation is also given of the positive heliotropism of stem structures. Both these aspects and others are now receiving attention.

Life movements in plants, J. C. BOSE (*Bose Research Inst., Calcutta, Trans.*, 1 (1918), pp. XXIV+251+XV, figs. 92; 2 (1919), pp. V+XIV+255-597, figs. 128).—A number of investigations on the phenomena of plant movements are here reported.

Part 1 deals with the response of plant organs, part 2 with growth and its responsive variations. The chapters deal with such topics as the problem of movement in plants, the action of stimulus on vegetable tissues, the conduction of excitation in plants, the electric control of the excitatory impulse, the high magnification crescograph for researches on growth, the effect of temperature, chemical agents, turgor and tension variation, electrical and mechanical stimulus, light, and indirect stimulus on growth, and a comparison of responses in growing and in nongrowing organs.

Volume II, continuing the same general subject and plan, deals with the intricate phenomena of the different tropisms, part 3 dealing with tropism in plants and part 4 with day and night movements. The investigations described are claimed not only to have supported the conclusions set forth in earlier writings, but to have led to important additions, the apparent limit of investigation being the limit of possibility of recording plant movement. The instruments devised to measure and record length increments in terms of time are said to have surpassed expectation, achieving refinements bearing promise of very important advances.

Attention is drawn more particularly to a few of the more important results. The tropic effect of light has been shown to have a definite relation to the quantity of incident light. A complete tropic curve has been obtained from subminimal to maximal stimulation which shows the inadequacy of Weber's law, for the subminimal stimulus induces a qualitative difference in physiological reaction. It has further been shown that the prevalent idea, that perception and heliotropic excitation are two distinct phenomena, is without foundation.

The theory of geotropic response, V. H. BLACKMAN (*New Phytol.*, 20 (1921), No. 1, pp. 38-42).—This is a discussion of the claims and views of Small and of Bose, as above noted, and of difficulties pointed out by the present author as supposedly involved in the theory of Small.

It is considered probable that the hydrogen-ion concentration of the protoplasm plays an important rôle in the cell processes, and that differences in this respect may explain the difference of geotropic response of the root and stem as assumed by the theory. If, however, reaction which takes place as rapidly as the geotropic response is to be correlated with the movement of the particles in a viscous medium, it would seem certain that such particles must be comparatively large and heavy, not ultra-microscopic.

The hydrion differentiation theory of geotropism: A reply to some criticisms, J. SMALL (*New Phytol.*, 20 (1921), No. 2, pp. 73-81).—A reply is made to the criticisms by Blackman noted above.

The reversal of geotropic response in the stem.—I, The effects of various percentages of carbon dioxid, M. J. LYNN (*New Phytol.*, 20 (1921), No. 3, pp. 116-123, pl. 1).—This work was undertaken with a view to obtaining further experimental evidence bearing upon the hydrion differentiation theory of geotropism recently offered by Small, as above noted, in particular that aspect of the theory which relates to the carbon dioxid of respiration as a differentiating factor in the growth curvatures of geotropism, according to which theory it is the hydrion concentration of the continuous phase of the pro-

toplasm in the cells of the region of gravity perception which determines the direction of the curvature resulting from response to the stimulus.

It became necessary to determine as closely as possible the minimum percentage of carbon dioxid which had to be added to produce reversal of the normal curvature. The different stages in the development of the work, which dealt with seedlings of *Clarkia elegans*, *Antirrhinum*, and *Helianthus annuus*, are described. From preliminary experiments, it became evident that reversal of normal curvature resulted when carbon dioxid was present in certain quantities in the atmosphere. It was further found in these preliminary experiments that *H. annuus* seedlings gave the best results because of their ready response to the stimulus of gravity under normal conditions, and because of their even greater readiness to show abnormal curvature under abnormal conditions.

Further experimentation carried out according to the same methods is indicated, the results of which agree closely with those above mentioned. It is clear that reversal of geotropic curvature occurs in the hypocotyls of seedlings of *H. annuus* when they are fixed horizontally in an atmosphere containing from 9 to 30 per cent of carbon dioxid.

Abscission of fruits in *Juglans californica quercina*, F. E. LLOYD (Roy. Soc. Canada, Proc. and Trans., 3. ser., 14 (1920), Sect. V, pp. 17-22, figs. 5).—Studies indicated that citrus fruits which were shed were always undersized to an amount approximately corresponding to growth during the period required for abscission. The observed slowing up of growth appeared to be referable to a cause indirectly resulting in abscission, namely, limited water supply, one factor in such reduction being the relatively reduced transmitting capacity of the stem tissues in comparison with the growth of the clustered fruits. It was thought that similar conditions might obtain in *J. californica quercina*, which usually loses, after the earlier periods of development, all of the young nuts but one in a cluster, and the practical proof of this view was obtained from examination of auxographic records of fruits which dropped during the summer of 1918 at Carmel, Calif.

It may be concluded that among the various conditions which lead directly or indirectly to abscission, water deficit beyond a certain limit is one, and that this is the condition which led to the abscission of the fruits under consideration. After abscission has proceeded sufficiently to break down the vascular tissues, no growth at all is possible, and at this point the process may be regarded as complete so far as the fate of the part involved is concerned. The usual loss of all fruits but one in a raceme is to be charged to the inadequacy of the stem in supplying the water lost by transpiration from the exposed fruit surfaces. It is therefore concluded that the active period of abscission was included within the last three days of the record.

It is thought that in the species herein discussed, abscission is brought about by the repeated too great water deficit in the tissues of the growing fruits resulting from competition between them, the stem being inadequate for the transmission of sufficient water. The process occupies, in all, three to five days, the major portion of abscission activity being confined to three days.

Falling foliage, M. T. Cook (New Jersey Stas. Rpt. 1920, pp. 570-573, pl. 1, fig. 1).—The author reports a great amount of falling foliage in 1919, which is attributed to various causes, among them the occurrence of low temperature at the time the leaves were being actively expanded, weak trees, spray injuries, brown rot of peach, peach scab, and cherry leaf spot.

Heterothallism and similar phenomena, E. M. CUTTING (New Phytol., 20 (1921), No. 1, pp. 10-16).—It is the purpose of this note to review briefly

observations and opinions dating back as far as 1906 relating to the presence of two kinds of mycelia in certain forms of fungi. Recent views discussed indicate the opinion (which appears to be increasing in prevalence) that transitions exist forming a series between homothallic and heterothallic forms, and that external conditions modify greatly the character of the method of reproduction.

FIELD CROPS.

Rotations and their significance, A. SJÖSTRÖM (*K. Landtbr. Akad. Handl. och Tidskr.*, 60 (1921), No. 1, pp. 19-39, figs. 6).—This article discusses field crop production in Sweden in the nineteenth century and at the present time in its relation to the rotation systems followed and the total areas devoted to certain crops. The factors which affected the rotations and the crop areas of the country are considered, and their influence on production and the economic situation generally is pointed out.

[Report of field crops work in New Jersey], F. APP and H. R. COX (*New Jersey Stas. Rpt.* 1920, pp. 208, 251-258).—Alfalfa seed produced in the vicinity of Kansas appeared to be sufficiently hardy and to give the best yield when used in that section of New Jersey south of New Brunswick. Fertilizer tests with corn on alfalfa sod were inconclusive, whereas results with potatoes indicated that a large application of phosphorus was the most efficient agent in maintaining the yield of potatoes after alfalfa.

Many of the late maturing corn varieties from southern States planted for silage did not produce as much dry matter as home-grown sorts, emphasizing the value of seed from within the State.

Immature seed potatoes, i. e., those dug in late July or early August while the vines are green, allowed to dry for a few weeks, and then placed in a cellar or cold storage until spring, were compared with northern seed and late-crop Giant seed from Virginia and southern New Jersey. The germination and vine growth throughout the season of the immature seed were generally better than of the northern seed. The immature seed set a heavier crop than the other kinds, but the tubers averaged smaller and more rot was present. G. R. Musgrave found seed from the southern counties of New Jersey to compare very favorably with stock from outside the State. Although the 1919 results indicate that the $\frac{3}{4}$ -oz. seed piece used by the average grower is rather small to obtain the maximum yield, less seed is apparently needed when late-crop New Jersey or Virginia seed is used, as a $\frac{1}{2}$ -oz. late-crop seed piece is about equal to a $\frac{3}{4}$ -oz. seed piece of New York or Maine grown stock.

[Culture tests at Flahult, Sweden, in 1920], H. WITTE (*Svenska Mosskulturför. Tidskr.*, 35 (1921), No. 5-6, pp. 280-299).—A report is presented on culture tests conducted by the Swedish Moorculture Association, and some of the more important results are noted.

In fertilizer experiments on upland moor meadows the best results were secured from the use of 200 kg. of nitrate of soda per hectare (178 lbs. per acre), the cost of the increase per pound of hay being about 0.9 ct. On nitrogen-poor upland moor meadows, an application of 200 lbs. of Thomas slag, 300 lbs. of potash salt, and 300 lbs. of nitrate of soda per hectare gave the highest yield, but owing to the high cost of the nitrate the profit due to the use of fertilizers was practically no greater than where the nitrate was omitted from the application. Liquid manure, at the rate of 300 hectoliters per hectare, furnishing 30.7 kg. of nitrogen and used on an upland moor meadow, increased the yield of hay by only 15 lbs. per pound of nitrogen applied, as compared with an application of potash equivalent to that in the liquid manure. The use of the

potash gave a marked increase in the stand of bird vetch (*Vicia cracca*) on the meadow.

Meadow land, under which the hardpan subsoil had been loosened with dynamite in 1913, produced in 1920 about 9 per cent more hay than the same kind of land not so treated. The use of a heavy roller the first year after upland moor soil had been sown to grass increased the yield of hay by about 10 per cent over the yield on the same kind of meadow receiving only a light rolling.

The results of experiments in seeding on different dates favored sowing oats on upland moor soils about May 14 and turnips on lowland about May 11. Sowing flax on May 18 and 28 and June 6 did not show great differences in the results. Applying 30 tons of barnyard manure per hectare in the spring gave a yield of potatoes about 30 per cent larger than where the same quantity of manure had been applied in the fall. The leading varieties of different crops under tests were as follows: Gull barley, Hede white oats, Moss black oats, Petkus and Jätte spring rye, and Midsummer and Harbinger potatoes.

[Report of field crops work in Assam], A. G. BIRT, J. N. CHAKRAVARTY, and J. McSWINEY (*Agr. Expts. and Demon. Assam, Rpt., 1921, pp. 6-18, 22-25, 28-37, 74-83, 89-102, 102, 103, 114-121, 125-129; abs. in Assam Agr. Dept. Rpt. 1921, pp. 4-6, 8-12*).—The continuation of work with field crops is reported along the same lines as heretofore (*E. S. R., 42, p. 132; 44, p. 633*).

The microscopic differentiation of important agricultural grass species in blossomless condition, H. SCHINDLER (*Ztschr. Landw. Versuchsw. Österr., 20 (1917), No. 3-4, pp. 115-160, figs. 19*).—Specific instructions are given for the microscopic identification of the various grasses found without flowering heads in sod or hay samples. The technique of the preparation of material and manipulation of the microscope are set forth in detail. The author presents a key for the identification of the individual grasses based on their anatomical differences as revealed in cross section. Drawings of microscopic enlargements, of cross section of leaves of various grasses are included.

Descriptions of new varieties of cereals, J. T. PRIDHAM (*Agr. Gaz. N. S. Wales, 32 (1921), No. 10, pp. 699-703, pls. 2*).—Brief descriptions and the origins are given of the following varieties, the former designations of which are in parentheses: Wheat, Forelock (Wagga No. 46), Riverina (Wagga No. 48), Early Bird (Wagga No. 50), Waratah (Wagga No. 47), Aussie (Wagga No. 51), Stamina (Wagga No. 52), Nullah (Cowra No. 15), Union (Federation×Cowra No. 15), Bald Knob (Cowra No. 19), Wandilla (Cowra No. 20), Ghurka (Cowra No. 24), and Warrah (Hawkesbury No. 7); oats, Yarran (Bathurst No. 5), Wilga (Bathurst No. 11), Quandong (Cowra No. 22), Mulga (Cowra No. 25), and Myall (Cowra No. 27); barleys, Trabut (No. 36) and Pryor (Cowra No. 21); and rye, Slav (Cowra No. 23).

Utilization of alfalfa, R. A. OAKLEY and H. L. WESTOVER (*U. S. Dept. Agr., Farmers' Bul. 1229 (1921), pp. 44, figs. 30*).—Practices applicable to making and storing alfalfa hay are described, and the causes and feeding value of brown hay considered, together with a discussion of the worth of alfalfa hay and pastures for cattle, horses and mules, sheep, hogs, and poultry. The uses of alfalfa as a soiling, silage, and orchard cover crop, as a green manure, and as a soil improver are outlined, and notes are included on the feeding value of alfalfa tea and straw, and the merits of fake and fad alfalfa products. Considerable of the data presented was secured in experiments and feeding trials conducted by the State experiment stations and this Department. The preparation and feeding of alfalfa meal and mixed feeds is treated in some detail, and the machinery essential to a well-equipped alfalfa mill is described and illustrated.

A mutation in a pure line of *Hordeum distichum*.—II, Hybridization experiments, L. KIESSLING (*Ztschr. Induktive Abstam. u. Vererbungslehre, 19*

(1918), No. 3, pp. 145-159).—The behavior in crosses of the barley mutation noted previously (E. S. R., 30, p. 36) is discussed in some detail.

The broom, E. ULBRICH (*Der Besenginster. Freiburg i. Br., Germany: Theodor Fisher, 1920, pp. [X]+125, pls. 4, figs. 18*).—A rather comprehensive work on the broom plant (*Sarothamnus scoparius*), including a brief historical account, a botanical study of the plant, notes on varieties, insect pests and diseases, descriptions of cultural and harvesting practices employed in producing the plant on waste land in Germany and other countries, and a discussion of its utilization as a source of drugs, dye, tanning material, and fiber. A short sketch on the Spanish or rush broom (*Spartium junceum*) is appended.

The original Iowa corn, D. F. MALIN (*Wallaces' Farmer, 46 (1921), No. 51, p. 1527, figs. 2*).—Descriptions are given of several strains of the maize grown by the Musquakie Indians on their reservation near Tama, Iowa, and said to be the original Iowa corn, with remarks on the agricultural progress of the tribe.

Corn culture among the Indians of the Southwest, H. M. STEECE (*Nat. Hist., 21 (1921), No. 4, pp. 414-424, figs. 13*).—The cultural methods and field operations employed in corn growing by the Navajo and Pueblo Indians of Arizona and New Mexico are described from field studies on Indian reservations, together with notes on harvesting customs and seed selection.

Effect of date of seeding on germination, growth, and development of corn, E. B. BROWN and H. S. GARRISON (*U. S. Dept. Agr. Bul. 1014 (1922), pp. 11*).—Observations were made on the germination, growth, and development of plants of different corn varieties planted at Arlington, Va., about the twentieth of each of the months of April, May, June, and July during the period 1915 to 1920, inclusive.

The rapidity of seed germination increased as the date of seeding was later, 17 days being required in April and 6 in July. The total stalk growth was largest in June and May seedings, and the most rapid rate of growth took place in June and July seedings. The least total growth and the slowest rate were found in April seedings.

Number of ears per stalk, size of ear, and amount of suckering were not consistently related to the date of seeding. Pollen shedding extended over a longer period in plants from the early seedings than in those seeded later. Planting earlier than normal resulted in slight gains in the date of silking.

Why not plant home-grown cotton seed? H. B. BROWN (*Mississippi Sta. Circ. 37 (1921), pp. 3*).—The importation of large quantities of cotton seed into Mississippi for planting purposes leads to the suggestion that home-grown seed could have been purchased for half the cost and with a large saving of transportation expense. In variety tests at the college station in 1920 (E. S. R., 45, p. 130) Mississippi-grown seed averaged 951 lbs. of seed cotton per acre while seed grown outside the State produced 817 lbs. Omitting the improved station strains from the averages still left a difference of 36 lbs. in favor of the Mississippi-grown seed. In each of three years, plants from home-grown King cotton have yielded slightly more than plants from North Carolina-grown seed of the same strain.

The cultivation of cotton in the French colonies (*Internatl. Inst. Agr. [Rome], Internatl. Rev. Sci. and Pract. Agr., 11 (1920), No. 5, pp. 578-584*).—Summarized accounts of the status of the cotton industry in Morocco, Ivory Coast, Sudan, French Guinea, New Caledonia, New Hebrides, Tahiti, Guadeloupe, and Cambodia.

Domestic fiber plants, G. SELLERGREN (*K. Landtbr. Akad. Handl. och Tidskr., 60 (1921), No. 5, pp. 388-424, figs. 13*).—This article, one of a series on the fiber

plants of Sweden, reviews the history of fiber flax production in Europe, treats of the morphology of the stem and the fiber cells of the plant, discusses the influence of soil type and fertilizer treatment on the growth of the plant and the value of the product, as based on results previously noted (E. S. R., 23, p. 39), compares different methods of retting, enumerates the various qualities that characterize good flax, describes several Swedish installations for the preparation of the flax fiber, and points out the need for standardizing and grading the fiber for market purposes.

The culture, retting, and stripping of flax (*La Culture du Lin le Rouissage et le Teillage*. Lille: Com. Linier France, 1921, pp. 27).—This pamphlet briefly discusses the status of flax culture in France, describes the cultural and field practices considered the most profitable, and outlines various methods of retting and stripping flax.

Flax grading, A. HOLM (*Nairobi: Kenya Colony Dept. Agr., 1921, pp. 6*).—A brief outline of the system of flax grading, devised by the Department of Agriculture of Kenya, with the grade brands for water and dew retted flax and tow.

Jute in Bengal, N. C. CHAUDHURY (*Calcutta: W. Newman & Co., Ltd., 1921 [2. ed., rev. and enl.], pp. XI+288, pl. 1, figs. 15*).—A revised and enlarged edition of the volume noted earlier (E. S. R., 21, p. 539), with the addition of chapters on the chemistry and history of jute and with the trade statistics brought up to date.

[Potato investigations in Germany in 1918 and 1919], O. APPEL and G. SCHNEIDER (*Arb. Forschungsinst, Kartoffelbau, No. 1 (1919), pp. 1-53, 57-63; No. 4 (1920), pp. 1-68, 73-80*).—Results of experiments with potatoes, including cultural, variety, fertilizer, size of seed, and time and rate of planting tests, seed production and breeding work, and harvesting and storage trials, conducted at various experimental centers in Germany, are summarized for the years 1918 and 1919.

[Rice production in Japan] (*Japan Dept. Agr. and Com., Ann. Rpt. Rice, 1920, pp. 4, pl. 1*).—Statistics are given showing the annual and normal yields of several types of rice in Japan and the normal crops in the several kens or prefectures. The average normal crop for the Empire is as follows: Area, ordinary paddy rice 6,549,252 acres, glutinous paddy rice 627,533 acres, and upland rice 310,205 acres; total production of husked uncleaned rice, ordinary paddy 15,362,198,000 lbs., glutinous paddy 1,360,415,000 lbs., and upland rice 371,279,000 lbs.; and acre yields, ordinary paddy 2,609 lbs., glutinous paddy 2,387 lbs., and upland rice 1,590 lbs.

The importance and future of root crop culture [in Sweden], L. FORSBERG (*K. Lantbr. Akad. Handl. och Tidskr., 60 (1921), No. 5, pp. 366-383*).—Historical and statistical notes on root crop culture in Sweden are presented, and the results of a number of experiments with different kinds and varieties of root crops, conducted in several localities for a series of years on various types of soil, are reported. In addition, the subject is considered from an economic standpoint.

In the different experiments described, mangels and Swedish turnips generally produced larger quantities of dry matter per acre than were secured from turnips and carrots. Barres Half Long mangel, in a 9-year test on a light clay soil, produced on an average 9,077 lbs. of dry matter per acre, ranking first in this regard, while Champion carrot ranking last yielded only 5,926 lbs. In dry matter content mangels and Swedish turnips, as a rule, ranked above turnips and carrots, but in some instances turnips produced the larger yields of dry matter as the result of heavy yields of roots. The

results of a 7-year test on alluvial clay soil showed an average yield of 76,576 lbs. per acre for Stubb turnip, which, with a dry matter content of only about 8.8 per cent, gave a yield of 6,765 lbs. of dry matter per acre, the highest in the experiment.

The yield of leaves for the different crops determined in the 9-year test above mentioned was 26 per cent of the weight of the roots for mangels, 18 per cent for Swedish turnips, 12 per cent for turnips, and 30 per cent for carrots.

The influence of lime [and nitrogenous fertilizers] on the yield and nitrogen content of soy beans, J. G. LIPMAN and A. W. BLAIR (*New Jersey Stat. Rpt. 1920, pp. 368-376, fig. 1*).—In further studies (E. S. R., 42, p. 826) of soy beans grown continuously on limed and unlimed plats since 1913, the limed plats in 1918 and 1919 averaged over 18 bu. of shelled beans and about 0.75 ton of dry stalks per acre, while the unlimed plats gave 9 bu. of beans and 726 lbs. of stalks in 1918 and 2 bu. and 243 lbs. in 1919. The dry shelled beans from the limed and unlimed plats contained 6.46 and 5.94 per cent, respectively, of nitrogen in 1918, and 6.56 and 6.33 per cent in 1919. Excluding the nitrogen in roots and fallen leaves, the limed plats returned an average of 87 lbs. of nitrogen per acre, while the unlimed plats recovered 38.2 lbs. in 1918 and 10.2 lbs. in 1919. In addition to a higher percentage of nitrogen, plants from limed plats uprooted when beginning to bloom had more than 10 times as many nodules as those from unlimed plats.

Ohio 9035 soy beans receiving no nitrogen gave higher yields of beans and stalks and a higher percentage of nitrogen in the shelled beans than those from plats fertilized with either 150 lbs. of nitrate of soda or an equivalent amount of ammonium sulphate. Nitrogen recovered from the nitrate, sulphate, and check plats amounted to 80.3, 71.8, and 88.8 lbs. per acre, respectively. Where Medium Yellow soy beans received similar treatment, except that calcium cyanamid was substituted for ammonium sulphate, the nitrate, cyanamid, and check plats produced 22.7, 22.6, and 21.5 bu., respectively, of shelled beans and recovered 100.8, 101, and 98.6 lbs. of nitrogen per acre.

Report on the sugar cane experiments for the season 1919-1921, J. R. BOVELL and J. P. D'ALBUQUERQUE (*Barbados Dept. Agr., Rpt. Sugar-Cane Expts., 1919-1921, pp. 37*).—Fertilizer and variety tests with sugar cane in Barbados are reported on as heretofore (E. S. R., 45, p. 132). The presence of the root borer (*Diaprepes abbreviatus* L.) and the brown hardback (*Phytalus smithi* Arrow) on the fertilized plats again rendered the results inconclusive.

In an experiment to determine the probable error in sugar cane experiments in Barbados, the difference between the mean yield from 1912 to 1921, inclusive, of the highest and the lowest plats amounted to 1.36 tons of cane per acre, or 4.67 per cent. The difference between the highest and the average of the plats was 0.53 ton, or 1.77 per cent, and between the lowest and the average, 0.83 ton, or 2.77 per cent.

Cuttings of large canes and small canes averaged 26.27 and 24.34 tons of cane per acre, respectively, with the larger giving 572 lbs. more of sucrose per acre. Cane from cuttings attacked by the moth borer gave 131 lbs. of sucrose per acre more than that grown from cuttings not affected by this insect. Cuttings from plant canes and first and second ratoons made respective acre averages of 28.79, 28.24, and 26.62 tons of cane.

The leading varieties in plat tests in the black soil districts with their acre production of muscovado sugar included Ba. 8846 with 3,770 lbs., B. 117 with 3,426 lbs., and B. S. F. 12(48) with 3,344 lbs., as compared with White Transparent with 1,890 lbs. The foremost varieties on red soils with their yields of

muscovado were Ba. 12079 with 5,363 lbs., Ba. 11569 with 4,938 lbs., and B. H. 10(12) with 4,823 lbs. The standard, White Transparent, produced 2,571 lbs.

In tests of selected varieties on black soil with plant cane for the years 1917-1921, inclusive, the highest yielders with their outturn of muscovado sugar were B. H. 10(12) with 6,480 lbs.; Ba. 8029 with 6,030 lbs.; and B. 39 with 6,022 lbs. White Transparent ranked twenty-sixth with an annual average of 3,967 lbs. for the period. On red soils B. H. 10(12), Ba. 11569, and Ba. 12079 averaged highest with 8,354, 6,903, and 6,861 lbs. of muscovado per acre, respectively.

Experiments with varieties of sugar cane, 1918-1920, H. A. TEMPANY (*Mauritius Dept. Agr., Gen. Ser., Bul. 23 (1921), Eng. ed., pp. 15*).—The continuation of experiments with varieties of sugar cane (E. S. R., 44, p. 832) is reported.

The leading varieties of plant cane in order of merit in 1920 included 33/231, D. 109, R. P. 8, and 75°, with respective acre yields of 43.8, 43.8, 40.6, and 46.8 tons of cane with sucrose contents of 16.73, 16.64, 17.11, and 14.9 per cent, respectively. T. 4, D. 130, R. P. 8, and 75°, with respective acre yields of 37.8, 31.7, 35.5, and 35 tons of cane with 16.33, 19.99, 17.52, and 17.33 per cent, respectively, of sucrose, were the highest producing ratoons. Sealy Seedling was highest in down-country plats in 1919 and 1920, while D. 109 and R. P. 8 led in up-country plats.

The distance between rows of sugar cane, W. E. CROSS (*Rev. Indus. y Agr. Tucumán, 11 (1921), No. 9-10, pp. 113-118*).—In further spacing experiments at Tucumán (E. S. R., 44, p. 437), plant cane of P. O. J. 36 and P. O. J. 213 returned the highest yields of cane and sugar in narrow rows, 0.9 to 1.5 meters (2.9 to 4.9 ft.). Ratoon crops of these varieties, as well as both plant and ratoon crops of Kavangire and Zwinga, gave maximum returns of cane and sugar anywhere within 0.9 to 2.4 meters (0.9 to 2.1 meters with P. O. J. 36). The cane in the narrowest rows had a slenderer stalk of lesser average weight than that from the wider rows, resulting in more stalks per acre. The richness of the cane appeared to be independent of the distance.

The sugar industry and its by-products, P. DE LA TORRE (*Cuba Sec. Hacienda, Secc. Estadis., Indus. Azucarera Zafra 1919-20, pp. 122, pls. 5*).—Statistical information is presented concerning the tonnage of milled cane, sugar, molasses, alcohol, rum, brandy, and other products produced in the provinces of Cuba, particularly for the campaign of 1919-20. A considerable amount of data is also included, indicating the quantities and value of sugar and by-products of the industry exported to various foreign countries.

The cereals of Greece.—I, Wheat, P. PAPAGEORGIOU (*Συμβολή Εἰς τὴν Ἑλληνικὴν Σιτηρογραφίαν.—I. Σίτος. Athens, 1919, vol. 1, pp. 139, figs. 31*).—Detailed descriptions and illustrations are given of the native and introduced varieties of wheat grown in the various sections of Greece, and the climatic and cultural requirements of the adopted native varieties are outlined. The author discusses the several species of Triticum and tabulates their more important varieties. Information regarding wheat improvement, wheat culture in ancient Greece, and the importance of the industry in modern Greece is included in a brief introduction.

Berkely Rock (53972) wheat, F. A. SPRAGG and E. E. DOWN (*Michigan Sta. Quart. Bul., 4 (1921), No. 2, p. 37*).—Berkely Rock is described as a hard red wheat superior to Red Rock (E. S. R., 40, p. 233) and equal to Turkey in winter hardiness, protein content, and milling and baking qualities, and with as stiff a straw as the popular Michigan varieties. Tests indicate that it is better adapted

to the region known as the Thumb of Michigan than to the sections where Red Rock is popular.

Durum wheat and durum flour, H. L. WALSTER (*Amer. Miller*, 49 (1921), No. 12, pp. 1239, 1240, fig. 1).—A discussion of the characteristics and possibilities of durum as a bread wheat, with results of comparative baking tests of durum flour at the North Dakota Experiment Station (E. S. R., 45, p. 831).

New Indiana seed regulations (*Grain Dealers Jour.*, 47 (1921), No. 11, p. 783).—These regulations, effective January 1, 1922, were promulgated in accordance with the new law to regulate the sale of agricultural seeds in Indiana.

Agricultural seed inspection, J. L. HILLS, C. H. JONES, G. F. ANDERSON, and A. S. LUTMAN (*Vermont Sta. Bul.* 223 (1921), pp. 19-30).—Tabulations show the purity guaranty, the percentage of germination, and the number of weed seed per pound of 362 samples of agricultural seed secured from local dealers in the State.

Report of the Weeds Commission, S. A. BEDFORD, G. WALTON, and H. B. BROWN (*Manitoba Dept. Agr. and Immigr. Ann. Rpt.*, 1920, pp. 33-36, fig. 1).—The fifth annual report of the Weeds Commission of the Manitoba Department of Agriculture (E. S. R., 44, p. 439).

Perennial sow thistle is reported as less prevalent than formerly, but Canada and Russian thistles have spread rapidly. Annual weeds were very evident in the 1920 grain crop, particularly on spring and fall plowed land, and in some cases reported by elevators as much as 25 per cent, by weight, of the seeds of these weeds were present in milling grain.

The most suitable method in Manitoba for the eradication of green foxtail (*Setaria viridis*) is to double disk, cultivate, or skim plow the stubble as soon as possible after harvest, preventing the late blossoming plants from seeding. The following summer, the weed is allowed to grow until a few inches high, and is then destroyed by shallow plowing or by use of the wide-toothed cultivator, care being taken that no seeds ripen during the summer.

HORTICULTURE.

Report of the department of horticulture, A. J. FARLEY, C. H. CONNORS, and L. G. SCHERMERHORN (*New Jersey Stat. Rpt.* 1920, pp. 65-90, pls. 2).—In this progress report (E. S. R., 44, p. 337), the results of an apple-pruning experiment are briefly reported without presenting data. In every instance no pruning resulted in greater yields than winter pruning. Trees with their leaders cut back were less productive than similar trees not so treated. Summer pruning was discarded as of no value under New Jersey conditions, except as a corrective measure in shaping the growth of the tree.

General observations are presented relative to some 650 seedling peaches, 546 of which were of known parentage, which fruited for the first time in 1919. Of these, 66 were deemed worthy of propagation for further trial. Tabulated records are presented relative to the inheritance of various characters. White flesh was found to be dominant over yellow flesh. Freestones crossed with clingstones gave a large proportion of clingstone seedlings, varying in accordance with the degree of clinginess of the parents and the inherent ability of the freestone parent to produce freestone seedlings when self-pollinated. A tendency of certain seedlings for late blooming was observed. Large and small sizes of blooms were found to be apparently homozygous characters, and medium size was evidently heterozygous between the two.

Measurements of the rate of growth of carnation flower buds at different periods of the producing season indicated that one to three weeks more are required

for development in winter than in either fall or spring. It was found that the greater part of the growth occurred during the night.

Yields obtained in fertilizer experiments with tomatoes conducted in 1919 at New Brunswick and Masonville are presented in tabular form. The variety grown was a station selection of Bonny Best. At Masonville the highest yield, an increase over the control plat of 5.8 tons per acre, was obtained on a plat receiving 800 lbs. acid phosphate, 200 lbs. potassium muriate, and 100 lbs. nitrate of soda per acre. At New Brunswick the highest yield was secured from a plat receiving 600 lbs. of acid phosphate alone. The increase in this instance was 6.7 tons per acre over the unfertilized plat. In a comparative test of 36 tomato varieties, John Baer was the highest yielder.

Permanent fruit and vegetable gardens, W. R. BEATTIE and C. P. CLOSE (*U. S. Dept. Agr., Farmers' Bul. 1242 (1921), pp. 23, figs. 11*).—With a view to assisting the home gardener, concise, practical instructions are given for the planting and care of the more important species of small fruits and perennial vegetables.

Selection and treatment of waters for spraying purposes, with especial reference to Santa Clara Valley, E. R. DE ONG (*California Sta. Bul. 338 (1921), pp. 301-314, figs. 2*).—Following a brief preliminary discussion of hard, alkaline, and saline waters and the inadvisability of their use in the preparation of spraying mixtures, the author gives an account of a survey of the waters of the Santa Clara Valley, in which it was found that only 13 per cent of the samples collected could be classified as soft. Various chemical and proprietary mixtures for softening water are discussed, with directions for the use of caustic soda (NaOH) which was found most satisfactory for very hard waters. Modified formulas are presented for making oil emulsions with waters of varying degrees of hardness, and information is given relative to the comparative emulsifying powers of several well-known soaps and soap powders. Inasmuch as water containing chlorin at the rate of 20 parts per million or more was found dangerous for use with acid arsenate of lead, it is recommended that basic arsenate of lead be used with very hard or alkaline waters. Analyses of California waters indicated that an unusually high percentage contain chlorin in excess, usually in the form of sodium chlorid.

Irrigation experiments, R. E. LOREE (*Michigan Sta. Quart. Bul., 4 (1921), No. 2, pp. 55, 56, fig. 1*).—As a result of overhead irrigation the yield of onions was increased 233 per cent, beets 86, carrots 66, lettuce 60, and early cabbage approximately 100 per cent. Furthermore, the quality was improved, less cultivation was required, no delay was incurred in seeding or transplanting, and desired rotations and more intensive croppings were made possible.

Effects of cultivation on soil moisture and on yields of certain vegetables, H. C. THOMPSON (*Amer. Soc. Hort. Sci. Proc., 17 (1920), pp. 155-161*).—In this test, conducted at Cornell University in 1919 and 1920 to determine the value of tillage to vegetables other than in the suppression of weeds, three different soil treatments were compared, (1) scraping the surface to kill weeds, (2) tillage, and (3) allowing the weeds to grow. In general the best yields were obtained from tillage; however, in 1920 carrots showed no benefit and cabbages failed to yield as well on tilled as on scraped plats. Moisture determinations of the soil of tilled and scraped plats in 1919 indicated but little difference in this respect. In an examination of the root growth of various vegetables involved in this study it was found that those vegetables which responded least to tillage possessed the greatest natural root development.

Some important factors in snap bean production, C. W. RAPP (*Amer. Soc. Hort. Sci. Proc., 17 (1920), pp. 116-119*).—In an investigation of the length of life

of the seed of several important garden bean varieties, prompted by the discovery that bacterial blight (*Bacterium phaseoli*) of the garden bean could be satisfactorily controlled by holding over infected seed for a 2-year period and then planting in disease free soil, it was found that certain varieties retain their viability over an extended period. Five-year-old seed of Round Yellow Six Weeks germinated under field conditions at the rate of 82 per cent.

Preliminary report on onion dormancy studies, H. A. JONES (*Amer. Soc. Hort. Sci. Proc.*, 17 (1920), pp. 128-133).—In this account of studies conducted for the most part at the West Virginia Experiment Station, the author discusses the results of observations upon the nature of and the factors influencing the rest period of the onion. Data are presented in tabular form relative to the time required for growth to commence in the greenhouse following different curing treatments in the field, and concerning the influence of different types of wounds upon the renewal of growth activities.

The constancy of the dormant period was indicated by the practically simultaneous root development of potted bulbs and of those left in the field. Cutting into the basal portion of the bulb stimulated the development of roots in a few days but had no effect on the development of the top growth. The removal of a portion of several of the outside scales did not stimulate growth in any manner. The moisture content of bulbs had no apparent influence on the duration of the dormant period. Individual bulbs within a variety differed greatly in the length of the rest period, leading the author to conclude that the isolation of strains with varying rest periods may be possible, providing this character proves to be hereditary.

Pimiento and bell peppers, H. P. STUCKEY and J. A. McCLINTOCK (*Georgia Sta. Bul.* 140 (1921), pp. 31-43, figs. 6).—Following a brief statement relative to the history of pimiento pepper production in the United States, general information is given relative to plant production, planting, culture, and harvesting.

Notes on spinach breeding, L. B. SMITH (*Amer. Soc. Hort. Sci. Proc.*, 17 (1920), pp. 146-155).—A discussion of methods and of plant materials employed at the Virginia Truck Experiment Station in the development of a mosaic-resistant spinach known as Virginia Savoy. Resistance to disease, which in this instance had been proved to be transmitted from plant to plant by aphids (E. S. R., 39, p. 550), was obtained by the use of a parent variety known as Manchuria, originally obtained in northern China by the late F. N. Meyer, of the U. S. Department of Agriculture. Counts showed that this variety possessed a resistance to mosaic in the proportion of one diseased in 10,500 plants. At first the Savoy variety was used as the other parent, but later round-leaf and thick-leaf types were crossed with the hybrid seedlings in order to introduce other desirable characters. Records of the comparative number of potato and spinach aphids infesting Savoy and resistant hybrid stocks showed that the hybrids were decidedly unattractive to these insects. As the result of a policy of selection, whereby lots showing more than 2 per cent mosaic were arbitrarily discarded, the percentage of disease was constantly reduced in each successive generation.

Size was recorded by comparative measurements of the height and diameter of mature plants. Savoying was measured by determining the increase in leaf area due to this factor, as compared with a flat leaf of the same perimeter. Among other details noted in the process of selection were color, thickness of leaf, length of petiole, and long standing characteristics.

Effects of nitrate of soda on the nutrition of the tomato, P. WORK (*Amer. Soc. Hort. Sci. Proc.*, 17 (1920), pp. 138-146).—In this study, conducted at the Minnesota Experiment Station tomato plants growing in a greenhouse under

carefully controlled environmental conditions and supplied with sufficient amounts of other nutrients were fertilized with various applications of nitrate of soda.

The results measured in 10 different terms of plant performance, including weight of fruit and of plant, indicated that of the amounts tested 32 gm. per plant (2,256 lbs. per acre) of nitrate of soda was the most effective application. A given amount of nitrate of soda when applied in several portions was apparently more effective than a single application. Excessive amounts up to 9 tons per acre did not induce a condition of high vegetation and unfruitfulness. The injurious effect of an excess of nitrate of soda is believed to be due to its action as an osmotic agent rather than as an active toxin. Chemical studies of the growth of the plants showed that the leaves of highly productive plants usually had a low carbohydrate content, while those of starved, unproductive plants for the most part were high in this material. The carbohydrate-nitrogen relation is discussed in its bearing on various results of the experiment.

The probable value of trunk circumference as an adjunct to fruit yield in interpreting apple orchard experiments, J. H. WARING (*Amer. Soc. Hort. Sci. Proc.*, 17 (1920), pp. 179-185).—A mathematical analysis of records obtained in apple fertilization experiments conducted by the Pennsylvania Experiment Station. Correlations were determined between trunk circumference and total number of pounds of fruit, (1) irrespective of variety and treatment, (2) for each variety regardless of treatment, and (3) for each variety divided into two sections, namely, those trees receiving nitrogen and those trees receiving no nitrogen.

In general a high degree of correlation was found to exist between trunk circumference and yield, with indications that this correlation decreases with the age of the trees. A single variety varied in degree of correlation according to geographical locations. Nitrogen as compared with no nitrogen was found to lessen the degree of correlation, apparently due to this element increasing yield at a much greater rate than trunk growth. As a result of the study it is concluded that trunk circumference records are of decided value in the interpretation of the results of apple orchard experiments.

A new factor in the determination of the hardiness of the apple, A. L. BAKKE, W. A. RADSPINNER, and T. J. MANEY (*Amer. Soc. Hort. Sci. Proc.*, 17 (1920), pp. 279-289).—An account of an experiment conducted by the Iowa Experiment Station in an effort to discover a short cut method of testing fruit trees for hardiness, in which determinations were made of the freezing point lowering, moisture content, ash content, and hardiness factor of the current year's growth of apple trees at five different periods, namely, (1) dormant, (2) bud swelling, (3) blossoming, (4) summer growth, and (5) wood ripening. Two sets of trees were included in the experiment, one comprising 18 well-known varieties in a 15-year-old apple orchard near Council Bluffs, and the other consisting of 14 varieties in a 2-year-old nursery near Shenandoah, Iowa. The data, in part presented in tabular form, led the authors to conclude that such determinations, especially during the blossoming period when all metabolic processes are at a maximum activity, have a value in indicating the hardiness of varieties.

Blueberry culture in Minnesota: A report of progress, W. G. BRIERLEY and W. H. KENETY (*Amer. Soc. Hort. Sci. Proc.*, 17 (1920), pp. 243-249).—A detailed report of studies, a summary of which has been previously noted (*E. S. R.*, 44, p. 739).

Cranberry investigations, C. S. BECKWITH (*New Jersey Stas. Rpt. 1920*, pp. 493-502).—In this progress report (E. S. R., 44, p. 339; 45 p. 216) certain deductions are presented, based on one year's results of various fertilizer studies.

In a determination of the optimum application of nitrogen per acre per annum for cranberries on Savannah soils, it was found that 30 lbs. gave a greater yield than 20 lbs. Nitrogen from nitrate of soda was equally effective as that obtained from a combined mineral and organic source. The optimum amount of phosphoric acid was found to be at least 80 lbs. per acre on Savannah soils, mud, and iron ore bottoms. The optimum amount of a tentative mixed fertilizer was 800 lbs., supplemented with 500 lbs. of acid phosphate. Calcium cyanamid proved to be an unsatisfactory source of nitrogen and barium phosphate of phosphoric acid.

In the project started to determine the optimum soil acidity index for cranberry soils, ground limestone applied for the successive years 1918 and 1919 in various amounts per acre failed to show any general effect on the crop.

Observations upon the culture of the strawberry, A. PETIT (*Jour. Soc. Natl. Hort. France*, 4. ser., 22 (1921), Dec., pp. 403-408).—Miscellaneous experiments with the Doctor Morère variety of strawberry are recorded. The results of a test of the effect of time of planting upon the weight of the first picking of fruit indicated the value of setting plants as early as possible after the appearance of the rooted runners. Plants brought into a greenhouse for forcing on December 1, February 1, and March 15 blossomed 105, 72, and 50 days, respectively, after their introduction. Etherization for 48 hours previous to introduction into the greenhouse failed to hasten the time of blossoming materially. In seeking to explain why plants growing in the greenhouse during the dull winter of 1907 failed to produce perfect berries, the author suggests that this phenomenon may have been due to the lack of sufficient sunlight, resulting in reduced carbon assimilation.

The home vineyard, L. O. BONNET (*California Sta. Circ. 231* (1921), pp. 12, figs. 4).—Concise practical information is given relative to varieties, propagation, planting, pruning, training, cultural requirements, and methods of combating insect and fungus pests. With one or two exceptions the varieties considered belong to *Vitis vinifera*.

Cordon pruning, F. T. BIOLETTI (*California Sta. Circ. 229* (1921), pp. 14, figs. 9).—Following a discussion of the advantages of the cordon type of pruning for vigorous growing *Vitis vinifera* grape varieties such as Emperor, Cornichon, Ohanez, Black Monukka, and Zabalkanski, the author describes three different types, one of which, designated as the unilateral horizontal cordon, is recommended as of particular value for many varieties. Detailed instructions are given for the establishment and maintenance of vineyards according to this system of pruning.

Phylloxera-resistant stocks, F. T. BIOLETTI, F. C. H. FLOSSFEDER, and A. E. WAY (*California Sta. Bul. 331* (1921), pp. 81-139, figs. 11).—Similar to investigations previously noted (E. S. R., 20, p. 557), this is a report of a test of 21 phylloxera-resistant grape stocks, part pure American species, part hybrids between various American species, and part hybrids between American species and *Vitis vinifera*. The data, largely in tabular form, present detailed information relative to (1) the suitability of stocks for nursery purposes, including cost of cuttings, ease of grafting, percentage and perfection of unions, and growth in the nursery, and (2) suitability for varied purposes, including character of the union, vigor of the bearing vine, durability of the vine, and quality and quantity of the crop.

As a result of a study of the compatibility between the various stocks and important commercial varieties of grapes, records are presented showing the

behavior and yield of many combinations, from which data the authors conclude that although it has been impossible to determine exactly the best stock for each scion, nevertheless certain combinations have been proved to be excellent, others fair, and still others deleterious. It is suggested that this information should be of material assistance to grape growers throughout California.

The late Dr. Walter Van Fleet, P. BISSET (*Amer. Florist*, 58 (1922), No. 1759, pp. 237, 238).—A brief account of the plant-breeding activities of the late Dr. Van Fleet (*E. S. R.*, 46, p. 199), recording the wide range of plants utilized and pointing out some of his notable achievements.

FORESTRY.

First annual report of the forestry commissioners for the year ending September 30, 1920 (*[Gr. Brit.] Forestry Commrs. Ann. Rpt.*, 1 (1920), pp. 60, pls. 3).—A résumé of the activities of the newly organized Forestry Commission of Great Britain for the year ended September 30, 1920.

Report of the forest administration of the Central Provinces for the year 1919-20, B. B. OSMASTON (*Cent. Prov. [India], Forest Admin. Rpt.* 1919-20, pts. 1, pp. 32; 2, pp. LXIII).—This report is submitted in two parts, the first containing the usual data (*E. S. R.*, 46, p. 238) relative to alterations in area, protective and planting activities, and general administration. The second part comprises detailed statistical statements concerning areas, revenues, etc.

Progress report of forest administration in the Jammu and Kashmir State for the year 1918-19, B. O. COVENTRY (*Jammu and Kashmir [India] Forest Admin. Rpt.*, 1918-19, pp. II+25+LIV).—In this report there are included the usual data (*E. S. R.*, 45, p. 142) relative to activities during the year, including alterations in area, protection from fire, general silvicultural operations, exploitation, and financial statements.

Annual report of the forest department for the year ended March 31, 1920, including report on railway sleeper plantations for the same period, C. E. LEGAT (*Union So. Africa, Forest Dept. Ann. Rpt.*, 1919-20, pp. II+31).—Similar to the report for the preceding annual period (*E. S. R.*, 43, pp. 839), data are presented relative to various activities in the State forests of the Union of South Africa. Among the subjects considered are alterations in area, fire protection measures, fungus and insect control, behavior of indigenous and exotic species, revenues, expenditures, etc. Seedlings of *Juniperus virginiana* are said to be appearing naturally throughout the coniferous areas of the Transvaal.

Annual progress report upon State forest administration in South Australia for the year 1920-21, W. GILL (*So. Aust. State Forest Admin. Ann. Rpt.*, 1920-21, pp. 12, pls. 7).—In accordance with the general plan of the preceding report (*E. S. R.*, 44, p. 838), the activities of the Woods and Forests Department for the year ended June 30, 1921, are briefly reviewed, with attention to planting operations, changes in area, distribution of young trees, revenues, expenditures, and changes in personnel.

Forest resources and opportunities in Georgia and other Southern States, W. B. GREELEY (*South. Forestry Cong. Proc.*, 3 (1921), pp. 59-69).—The author emphasizes the extent and importance of the forest resources of the Southern States, and urges the utilization of idle lands for forestry purposes with proper attention to fire protection.

Extensive planting plan to save Ontario's pine supply, E. J. ZAVITZ (*Canad. Forestry Mag.*, 18 (1922), No. 1, pp. 564-566, 594, 595, figs. 4).—In this

address, delivered before the forestry section of the American Association for the Advancement of Science, the author emphasizes the rapidly approaching exhaustion of the virgin pine forests of Ontario. A plan is suggested involving the establishment of five forest experiment stations, each of sufficient size to supply annually nursery trees for 10,000 acres, the operation of which would insure a permanent timber supply for Ontario.

Reclamation of grasslands by Utah juniper on the Tusayan National Forest, Arizona, F. H. MILLER (*Jour. Forestry*, 19 (1921), No. 6, pp. 647-651).—In an effort to account for the natural reproduction of junipers on open areas often one or two miles from a seed tree, studies were made of the nature of the soil, the age of the seedling trees, and the probable means of dispersal of seed. It was found that 80 per cent of the young trees were less than 13 years of age, and that all were less than 25 years, during which period animals had grazed upon the area. The principal forage plant, tobosa grass, did not entirely cover the ground, thus allowing the young seedlings an opportunity to develop. The character of the soil, subject to frost heaving and slight cracking afforded an entrance for the seeds. The presence of seeds in the droppings of sheep led to the conclusion that these animals were the active agents in dissemination. The greater prevalence of *Juniperus utahensis* than of other species of *Juniperus* is believed to be due to the fact that sheep prefer this seed on account of its larger size.

The use book: Grazing section, 1921 (U. S. Dept. Agr., Forest Serv., Use Book, *Grazing Sect.*, 1921, pp. 80).—This portion of the manual of information previously noted (E. S. R., 39, p. 750) presents regulations and extracts from instructions relative to the use of the National Forest ranges for grazing purposes. A tabulated list of the Forests arranged alphabetically according to States is included, showing the headquarters of the various forest supervisors.

Detection of flavone and fluorescence of the watery extract of woods as aids in identification, R. KANEHIRA (*Jour. Forestry*, 19 (1921), No. 7, pp. 736-739, fig. 1).—Subsequent to a brief outline of methods employed in determining the flavone content and fluorescence of woods, a tabulation is given of the results obtained in a study of 69 North American species.

The southern beech (*Nothofagus*) forests of New Zealand, L. COCKAYNE (*New Zeal. Jour. Agr.*, 23 (1921), No. 6, pp. 353-360, figs. 3).—In this article, emphasizing the importance of the southern beech forests in New Zealand, it is pointed out that there are, besides the six well-known species, a large number of variable forms which in some cases are so distinct that they might be considered as separate species.

On the viability of tree seeds after storage for ten years, J. W. T[OUMEY] (*Jour. Forestry*, 19 (1921), No. 7, p. 814).—A brief account of a viability experiment in which seeds of 30 forest tree species, stored in a warm cellar with exposure to light and air, were tested for germination after a 10-year period. Ten of the 30 species were found to contain viable seeds of sufficient strength to develop into trees.

Fuel value of wood, A. K. CHITTENDEN (*Michigan Sta. Quart. Bul.*, 4 (1921), No. 2, pp. 58-60).—Pointing out that the fuel value of wood is in proportion to the weight of the thoroughly dried material, the author presents in tabular form the green and dry weights per standard cord for 11 common species. Another table is included showing the average number of trees of various diameters required to furnish one cord of wood. Estimating the volume increase in a thrifty wood lot as 4 to 5 per cent per annum, it is stated that $1\frac{1}{2}$ cords may be cut each year from lots containing 30 cords per acre.

DISEASES OF PLANTS.

Report of fungus diseases for 1920, T. F. MANNS (*Peninsula Hort. Soc. [Del.], Trans., 34 (1921), pp. 72-77*).—Apple blotch was very severe this year on early apples in lower Delaware, making it necessary to use an extra early spray for the control of *Phyllosticta solitaria*. Apple scab (*Venturia pomi*) is still difficult of control, an important factor in which is a delayed dormant spray. Apple rust (*Gymnosporium macropus*) is becoming more severe, especially around Milford. Apple fruit spot (physiological) was in some places more severe than usual, attacking several varieties including some hitherto considered immune. Apple root rot is said to be caused by the same organism as fire blight, the cause of which, *Bacillus amylovorus*, gets access at bark injuries due to sun scald or frost injury.

Crowngall (*Bacterium tumefaciens*) is causing much injury in connection with seedlings of peach, apple, raspberry, and blackberry.

Pears were severely attacked by foliage troubles, due chiefly to *Entomosporium maculatum*, the fruit being badly marked in some cases. Three sprayings with Bordeaux mixture controlled the trouble, also that due to *Septoria pyricola*.

Grape rot (*Gloeosporium ampelophagum*) was controlled by the employment of hand spraying.

The collapse of a promising strawberry crop was ascribed in some cases to insufficient fertility.

Corn root rot was common, causing 10 to 15 per cent loss. The trouble has not been fully understood, but is shown by test to be due to some seed-borne organism.

Pea root rot is due to bad soil conditions, the most actively infective fungus probably being *Pythium debaryanum*. Sick soil may be produced in case of any one of the numerous local field crops.

Cabbage yellows (*Fusarium conglutinans*) is resisted successfully by the variety Volga, which will mature a good crop when planted late in July and given a top-dressing of nitrate. Cabbage foot rot (*Phoma oleracea*), usually carried from the seed bed, is controlled by the hot water seed treatment and by use of Bordeaux on the young plants.

Celery blight, both early and late, was even more prevalent than in the previous season. Bordeaux mixture readily controls both diseases. Cantaloup suffered much from fruit rot. Peach blossom blight was very severe in old orchards that had been sickened by brown rot. Previous observation that blossom blight comes directly from the cup stage of the fungus that overwinters in rotten fruit has been confirmed. The fruit blight overwinters in the cankers produced as the result of blossom blight.

The sweet potato crop was reduced nearly 50 per cent by drought and by disease factors, of which stem rot appears to be the worst, though soil rot, scurf, and black rot are of economic importance.

Potato late blight (*Phytophthora infestans*) has caused loss on different areas, ranging from 5 to 50 per cent of the crop. Experience with one field indicates that if potatoes are left in the ground after the vines are blighted the percentage of rot increases considerably under damp weather.

Report of the mycologist, W. F. BEWLEY (*Expt. and Research Sta., Cheshunt, Herts., Ann. Rpt., 6 (1920), pp. 26-51*).—Investigations during the year were concerned largely with tomato sleepy disease and the problem of water contamination in relation to plant disease. Further work has been done with tomato stripe disease. Diseases noted include, in addition to previous notations, tomato and cucumber sclerotium disease (*Sclerotinia sclerotiorum*),

cucumber gummosis (*Cladosporium* sp.), Cineraria foot rot (*Phytophthora cryptogea*), Geum root rot (*Rhizoctonia solani*), tulip bulb dry rot (*Fusarium* sp.) and strawberry soft rot or leak (*Botrytis* sp.).

Sleepy disease causes loss in all tomato-growing parts of the British Isles. The disease is described. *Verticillium albo-atrum* was found in 96 per cent, and *Fusarium lycopersici* in 4 per cent of the sick plants examined. Inoculation studies with other plants are detailed, as are also studies on temperature relations, water-supply contamination, and control measures.

Stripe disease of tomato is identical with streak disease. This is infectious and will cause a like disease in sweet pea, garden pea, red clover, broad bean, alfalfa, lupine, vetch, sainfoin, and potato.

The works of Mrs. D. J. Matthews on the effects of sterilizing agents applied to growing plants is detailed for carbolic acid, formaldehyde, sodium cyanid, dichlorocresol, chloropicrin, nitrobenzene, chlorodinitrobenzene, picric acid, Sulgene, lime, thiocyanates of sodium and potassium, naphthalene, and calcium sulphid with naphthalene, also for steam and hot water.

Pathological [report], I. B. P. EVANS (*Union So. Africa Dept. Agr. Rpt. 1918-19, pp. 77-79*).—No new diseases of any great importance were observed during the period under review, but owing to early rains *Eoascus deformans* was severe almost throughout the Union.

The citrus canker eradication campaign has been vigorously continued during the past year and good progress has been made against the disease, of which new outbreaks were discovered on five farms in the Transvaal.

Study has been continued of the citrus canker organism (*Bacterium citri*) and a comparative study has been undertaken of four organisms belonging to the so-called yellow *Pseudomonas* group, namely, *B. citri*, *B. juglandis*, *B. phaseoli*, and *B. campestre*. Cotton bacterial spot (*B. malvacearum*) has become somewhat prevalent on cotton in certain portions of the Transvaal, Natal, and Swaziland. A wheat smut (*Urocystis* sp.) was sent in from Zeerust, where it had done considerable damage. The disease, which has not yet yielded to seed treatment, attacks heads, stems, and leaves. Kikuyu grass blotch (*Helminthosporium* sp.) appears to attack destructively only under unfavorable conditions. A dying-off disease of *Cupressus macrocarpa* hedges and *Cupressus* seedlings is due to a species of *Phoma*. Spraying with Bordeaux mixture was effective. The production of fairy rings on bowling greens was attributed to the fungus *Lycoperdon furfuraceum*. Spraying experiments against walnut bacteriosis have not yet led to any definite conclusions. Almond and apricot die-back, which has been prevalent in the Western Province of the Cape for some years, is being investigated and a *Schizophyllum* has been isolated.

The investigation of papaya leaf spot has been continued. A dying-off disease of rhenoster bush appears to be due to a *Polyporus*. Decay of fruit, particularly apples, in cold storage has been investigated and is said to be due to the presence of abundant rotting organisms in connection with slight mechanical injury to the fruits. The prevalence of the disease has been lessened by increased care in handling the fruit.

[Plant diseases in India], S. MILLIGAN (*India Bd. Agr., Proc. Meeting Mycol. Workers, 3 (1921), pp. 8-35*).—This portion of the agricultural adviser's report of the meeting held at Pusa, February 7, 1921, contains, in addition to a discussion on the physiology of disease, an account of a survey of diseases of crops including wheat, oats, durra, barley, maize, rice, sawan, potato, chilli, castor bean, tobacco, poppy, tomato, cardamon, cotton, sugar cane, palm, and bamboo, also a discussion on spraying.

Perennial mycelium of parasitic fungi, L. H. PAMMEL (*Iowa Acad. Sci. Proc.*, 25 (1918), pp. 259-263).—The author submits his notes collected from time to time on parasitic fungi, stating that cases of perennial mycelium are much more common than was formerly thought, and that for this reason the thorough destruction of weeds receives additional justification from the facts presented.

The distribution of Swiss Peronosporas, E. GÄUMANN (*Mitt. Naturf. Gesell. Bern*, 1919, pp. 176-187).—Discussion, involving tabular and descriptive detail, is given regarding the genus *Peronospora*, of which there are said to be in Switzerland 142 species on 222 hosts, in Germany 168 species on 281 hosts, and in France 102 species on 119 hosts.

The Rhizoctonias of Porto Rico, J. MATZ (*Jour. Dept. Agr. Porto Rico*, 5 (1921), No. 1, pp. 31, pls. 25, fig. 1).—Systematic description and discussion are given of nine species of *Rhizoctonia* found in Porto Rico, with an account of their prevalence and other economic bearings.

Investigations on the purity of strain and freedom from bunt and stripe disease of seed, J. HOLMGAARD (*Tidsskr. Planteavl*, 27 (1921), No. 4, pp. 553-599, figs. 8).—This is a report, with English summary, from the Danish State Seed Testing Station regarding field and laboratory studies carried on during 1917-1920, dealing with purity, germinating power, and freedom from seed-borne disease of certain wheat, barley, oat, and rye varieties.

Data are recorded for the severity of attack by *Pleospora graminea*, *Ustilago nuda*, *U. hordei*, *U. avenae*, *U. laevis*, *U. tritici*, *Tilletia caries*, and *Urocystis occulta*.

The control of cereal smuts in Washington, F. D. HEALD and G. L. ZUNDEL (*Wash. State Col. Ext. Bul.* 72 (1921), pp. 21, figs. 8).—Descriptions are given of the different smuts attacking cereals, with suggestions for their control.

Recent experimentation on barley leaf stripe control, H. C. MÜLLER and E. MOLZ (*Deut. Landw. Presse*, 48 (1921), No. 56, p. 419).—Injury to barley crops, ranging from slight to severe and due to leaf stripe disease (*Pleospora trichostoma*, *Helminthosporium gramineum*), is described as becoming apparent about the middle of May, 1920.

Early experience in attempts at control of this seed-borne disease is noted as employing different fungicides. Experience during some years gave first place to the preparation Corbin, but this was later excelled by Uspulun. For several years the preparation Germisan (= Ko 6) has held first place as a seed treatment against leaf stripe. This preparation has also proved efficacious against wheat stinking smut. For leaf stripe, the usual strength is 0.25 or 0.75 per cent, according as dipping or sprinkling is employed and as regards the severity of the infection.

If Uspulun is used, the seed should be soaked for one hour in 0.25 or 0.5 per cent solution. This preparation does not give, in case of severe infection, the complete protection that is given by Germisan.

A preliminary note on the inheritance of rust resistance in oats, R. J. GARBER (*Jour. Amer. Soc. Agron.*, 13 (1921), No. 1, pp. 41-43, fig. 1).—During the summer of 1918, crosses were made between White Russian oats (*Avena sativa orientalis*) resistant to stem rust (*Puccinia graminis avenae*), and a selection from each of the two highest yielding varieties, Minota and Victory, both of which are very susceptible to stem rust. The results, which are briefly detailed, furnish evidence of a single hereditary factor difference with respect to the rust reaction of the host plants used as parents. Resistance apparently behaves as a dominant character in these crosses.

Disease [of wheat in New South Wales] (*Agr. Gaz. N. S. Wales*, 32 (1921), No. 3, pp. 187, 188).—In this portion of a report by W. R. Birks on the Royal

Agricultural Society's third field wheat competition, it is stated that all the commoner diseases of wheat have been met with. Particular mention is made of rust, flag smut, take-all, and bunt, the last named being by far the most serious.

Hot water treatment for seed wheat, F. J. PIPAL (*Purdue Agr. Ext. Bul.* 100 [1921], pp. 16, figs. 5).—Directions are given for the treatment of seed wheat by the hot water method for the control of loose and stinking smut of wheat. The treatment recommended consists of soaking the wheat for 4 to 6 hours in cold water, dipping it for 1 minute in water heated to 120° F., and soaking for 10 minutes in hot water at 129°, with constant agitation, after which the wheat is dipped in cold water and spread for drying.

A simple method for controlling loose smut in wheat, W. C. ETHERIDGE (*Missouri Agr. Col. Ext. Circ.* 108 (1921), pp. 4, figs. 3).—Directions are given for the hot water treatment of seed wheat for the control of smut. The author recommends the treatment of the seed for 15 to 20 minutes in water heated to 131° F.

Progress of barberry eradication, F. E. KEMPTON (*U. S. Dept. Agr., Dept. Circ.* 188 (1921), pp. 37, figs. 4).—A report is given of the progress that has been made in eradicating the common barberry in 13 of the North Central States during the seasons 1918 to 1920 inclusive.

Progress in barberry eradication in Illinois during 1919, L. R. TEHON (*Ill. State Acad. Sci. Trans.*, 13 (1920), pp. 219-225, figs. 2).—The barberry eradication campaign in Illinois, which began in 1918, was conducted on a slightly different plan during the second year, and brief statements are given regarding the work and results during these two years. An instance is given of the spread of rusts from a barberry hedge by way of wild grasses to wheat and oats.

The results of the 1919 work have emphasized the importance of barberry eradication to rust control.

Ergot, W. A. BIRMINGHAM (*Agr. Gaz. N. S. Wales*, 32 (1921), No. 6, pp. 410-412, fig. 1).—After a brief discussion of rye ergot in connection with control measures, the author states that specimens of blue grass (*Andropogon inter-medius*) from Bathurst Experiment Farm showed a sticky secretion on the panicles associated with the sphacelial stage of *Claviceps* sp., but that the ergot form was not found. The ergot stage was found on wheat, rye, Hungarian or awnless brome grass (*Bromus inermis*), a canary grass (*Phalaris minor*), Loietto rye grass (*Lolium multiflorum* var.), and three varieties of fescue (*Festuca elatior*, *F. arundinacea*, and *F. hookeriana*). Three species of *Claviceps* recorded from grasses are *C. purpurea*, *C. microcephala*, and *C. setulosa*. Specimens of *Pollinia fulvum* and of *Panicum bulbosum* attacked by ergot (*Claviceps* sp.) have been submitted.

Ergot appears to be more prevalent in warm, moist seasons. Previous records of its appearance in Australia are indicated.

Vegetable parasites of alfalfa, G. GÁNDARA ([*Mex.*] *Sec. Agr. y Fomento. Dir. Agr. Bol.* 110, n. ser. (1920), pp. 24, figs. 17).—A brief general account is given of higher and lower plant parasites of alfalfa (*Medicago sativa*).

Inheritance of disease resistance in the common bean, G. P. McROSTIE (*Jour. Amer. Soc. Agron.*, 13 (1921), No. 1, pp. 15-32).—The data and discussion recorded in this paper represent the results of observations for more than three years on the mode of inheritance in *Phaseolus vulgaris* of the factors concerned in the production of resistance to bean anthracnose, mosaic, and root rot. A short résumé is given of the literature pertaining to the mode of inheritance of factors responsible for disease resistance.

The investigations regarding bean anthracnose indicate a single factor difference between resistance and susceptibility where only the α strain of the fungus is concerned in the cross. Where both the α and β strains are concerned a two-factor difference is indicated, and a 9:7 ratio in the F_2 is obtained. In both instances resistance is dominant over susceptibility. Crosses involving the inheritance of susceptibility to bean mosaic indicate in F_1 and F_2 a partial dominance of susceptibility over resistance. A two-factor hypothesis is offered with supporting observations. Inoculation results of F_2 hybrids from crosses involving the inheritance of susceptibility to root rot show susceptibility to be dominant over resistance. A tentative two-factor hypothesis is advanced regarding the inheritance of susceptibility to root rot with a 9:7 ratio in the F_2 between susceptible and resistant plants.

A number of promising strains of beans have been isolated which show resistance to anthracnose. A few hundred heavily podded F_2 types have been selected which show resistance to both root rot and mosaic and which should also be resistant to the β strain of the anthracnose fungus. Further testing should isolate some very desirable resistant commercial types from these selections.

Celery disease investigations, R. F. POOLE (*New Jersey Stas. Rpt. 1920*, pp. 608, 609, pl. 1, fig. 1).—A brief account is given of experiments conducted for the control of bacterial diseases of celery in which a number of compounds were added to the soil. Corrosive sublimate and copper sulphate at the strengths used were found to injure the plants, stunting their growth.

The organism causing the celery rot was isolated and compared with the organisms described under the names *Bacillus apiovorus* and *B. carotovorus*, both of which are said to produce soft rots of vegetables. The author doubts whether strains of this soft rot bacillus should be given as different species, experiments showing that the character of rot symptoms is due to the physiological conditions of both host and parasite.

Prevalence and distribution of fungi internal of seed corn, T. F. MANNS and J. F. ADAMS (*Science, n. ser.*, 54 (1921), No. 1399, pp. 385-387).—An account is given of investigations conducted to determine the species of fungi associated with seed corn. The authors report an efficient test for the determination of such fungi. The seed are disinfected with a corrosive sublimate solution, after which they are cultured in Petri dishes. Samples of corn from 21 States were studied and the following fungi, arranged in the order of their importance in inhibiting germination, were found: *Diplodia zeae*, *Gibberella saubinetii*, *Fusarium moniliforme*, and *Cephalosporium sacchari*. It is stated that *C. sacchari* is reported as a parasite of corn for the first time in this country.

The authors state that a careful study of the anatomy of seed showed that heavy infection after the treatment indicated how these parasitic fungi escaped the disinfectant. In most cases where the internal pathogenes were not inhibiting germination, the fungi had gained entrance only to the cavity under the cap, or had penetrated but short distances under the pericarp. Whenever any of the pathogenes became established in the tissues comprising the embryo the vitality was either destroyed or greatly inhibited.

Report of corn root and stalk rot investigations, 1919, I. C. HOFFMAN and M. T. COOK (*New Jersey Stas. Rpt. 1920*, pp. 598-604).—The results are given of ear-to-row tests of selections of corn to determine the field performance of disease-free and diseased ears as determined by germination tests.

Inspections made of the stand and conditions of the plants from time to time indicated that the disease-free corn maintained throughout the season a decided increase in total stand over other groups. A close examination of the ears showed marked differences in their composition. They were arranged

in two classes, starchy and horny. The yield of starchy corn was 8.98 bu. larger than that of the horny corn in the disease-free group. The starchy disease-free group yielded more than any other group, and the horny diseased group yielded the least.

Horse-radish root rot investigations, R. F. POOLE (*New Jersey Stas. Rpt. 1920, p. 610, fig. 1*).—A brief account is given of a bacterial disease of horse-radish which has been under investigation, in which the organism was isolated and its pathogenicity proved. It is believed that the disease was present in the horse-radish roots when they were set in the field. A number of species of fungi were isolated from diseased roots, and their relation to horse-radish rots is to be studied further.

Onion smut (*Min. Agr. and Fisheries [London], Leaflet 365 (1921), pp. 6, figs. 2*).—Onion smut (*Urocystis cepulae*) is noted as a new disease in England, occurring in strictly localized areas near Northampton, St. Neots, and Kendal, and in market gardens at two places in Northumberland.

Degeneration in potato, J. GAGET (*Jour. Agr. Prat., n. ser., 35 (1921), No. 16, pp. 316-318*).—Evidence offered would seem to indicate that degenerescence observed in potato tubers is due to plant lice, the parasitism of which is considered as proved. Control measures are suggested.

Field studies on potato diseases, M. T. COOK (*New Jersey Stas. Rpt. 1920, pp. 573-577*).—Observations are given on the occurrence of a number of potato diseases, the more important of which are blackleg, powdery scab, common scab, Rhizoctonia, early blight, late blight, dry rot, weather injuries, mosaic, and leaf roll.

In commenting upon some of these diseases, the author states that the experimental work carried on shows that the amount of infection in scurf or Rhizoctonia occurring on seed tubers is no index of the severity of the disease in the field. Experiments for the control of these tuber diseases in which corrosive sublimate and formaldehyde were compared showed that the best results were obtained where corrosive sublimate was employed. Mosaic and leaf roll are both said to reduce the yield of potatoes greatly, and experimental tests are said to show that the mosaic disease is transmitted in the tubers, reduces the yield, and increases in severity from year to year.

Report of potato spraying tests, W. H. MARTIN (*New Jersey Stas. Rpt. 1920, pp. 577-587, pl. 1*).—The results are given of two cooperative experiments which were carried on, one with Irish Cobblers and the other with American Giants grown as the main crop, and also the spraying of a late-planted crop of Irish Cobbler.

In one of the experiments homemade Bordeaux mixture of the standard 5:5:50 formula was compared with a proprietary zinc Bordeaux mixture, and the results obtained showed little difference for either of the mixtures. As a result of spraying, the average increase over the check plot where homemade Bordeaux mixture was used was 49.6 bu., while with the commercial mixture 50.6 bu. was secured.

In the second test, comparisons were made of spray mixtures composed of calcium arsenate, lead arsenate, Paris green, and Bordeaux mixture. In this case the variety used was the American Giant, and the conflicting results obtained are thought to be due to the fact that this variety makes very rapid growth, soon filling the rows, and making it impossible to use the spray late in the season.

For the late-planted crop, potato spraying is said to have given increased yields every year, even in the absence of late blight, an average increase of 50.8 bu. being obtained in favor of the spray treatment.

Treatment of scab in seed potatoes, C. O. HAMBLIN (*Agr. Gaz. N. S. Wales*, 32 (1921), No. 6, pp. 417-419, figs. 2).—Having tested on a small scale the method described by Melhus and Gilman (*E. S. R.*, 41, p. 38) of treating scabby potato seed with hot formaldehyde, the author reports on that work.

Scab has three main local causes, *Rhizoctonia solani*, *Actinomyces scabies* (*Oospora scabies*), and nematodes (*Heterodera radiculicola*), the second of these being difficult of detection, the third relatively common, and the first usually present in abundance. The hot formalin treatment controls *Rhizoctonia* potato scab very effectively, but has little effect on scab due to nematodes. No detrimental effect is produced by this treatment (with formalin at 122° F.) on the germinating power of the seed tuber so long as the potatoes have not begun to sprout.

Seed treatment for the control of potato scab, W. H. MARTIN (*New Jersey Stas. Rpt. 1920*, pp. 587-590, fig. 1).—Scabby tubers of the variety Irish Cobbler were treated with formaldehyde and corrosive sublimate solutions, and it was found that either treatment gave a better stand than untreated scabby seed. Soaking scabby seed in either of these solutions led to increased yields and a marked increase in salable potatoes over the check plats. Sprinkling tubers with either formaldehyde or corrosive sublimate was found not only to reduce the amount of scab but to increase the total yield, indicating that this method of treatment may be of some value.

The influence of sulphur on soil acidity and the control of potato scab, W. H. MARTIN (*New Jersey Stas. Rpt. 1920*, pp. 590-598, fig. 1).—In continuation of previous experiments (*E. S. R.*, 45, p. 650), a report is given on the use of sulphur for the control of potato scab. With the different amounts of sulphur used, all gave substantial gains in the number of clean tubers, but even with the heaviest application scab was not entirely eliminated. The experiments are believed to indicate that with those varieties of potatoes known to scab severely, the use of sulphur in the proper amount will render a large portion of the crop salable. In all cases following the application of sulphur there was an increase in soil acidity, and in most instances this increase was in proportion to the amount of sulphur applied. It is considered necessary that the reaction of the soil should be known before sulphur applications are made, in order to determine the amount of sulphur to apply.

Artificial production of tipburn, F. A. FENTON and I. L. RESSLER (*Science*, n. ser., 55 (1922), No. 1411, p. 54).—The authors give an account of experiments conducted at the Iowa Experiment Station which indicate that the potato leafhopper (*Empoasca mali*) is the factor in the production of tipburn or hopper burn of potato.

Emulsions were made by crushing a large number of adults of both sexes in water, and small amounts of this water were injected into the leaves of the potato plants. In a few days an injury similar to, if not identical with, tipburn resulted. Emulsions made from crushed nymphs failed to produce typical injury except in a few cases. That the insects contain some toxic substance was demonstrated further by placing the residue left over from the insects after the emulsion had been poured off on leaf petioles and pricking this into the petiole by means of a fine scalpel. In every case a lesion was produced at the points, the tissue at these points turning yellow and then brown, and later the cells collapsed.

Investigations conducted to determine the action of Bordeaux mixture are said to indicate that the fungicide does not prevent tipburn by its action on the leaf but rather by its action on the insect.

Wart disease of potatoes: Results of immunity trials in 1920 (*Scot. Jour. Agr.*, 4 (1921), No. 1, pp. 68-72).—In 1919 the Board of Agriculture for Scotland acquired two plats of land, one at Philipstoun, Linlithgowshire, and one at Duddingston, Edinburgh, to use in making trials regarding immunity from wart disease of potato varieties, similar to the trials conducted at Ormskirk. Arrangements were also made for establishing in 1921 a registration station for testing, recording, and certifying new varieties of agricultural plants, including potatoes.

The trials in 1919 were inconclusive on account of drought, but in 1920 the season was very favorable for a test. In all, 210 samples were submitted for testing, excluding 80 sent by the U. S. Department of Agriculture. In addition, 116 samples of susceptible and immune varieties were interspersed among the plats for the purpose of control and comparison. Of the varieties sent in for trial, 106 have shown no sign of wart disease, which has been identified on the remaining 104. Fifty-four of the varieties apparently immune and 40 showing susceptibility appeared to be new and distinct, the remainder belonging to standard types. A certificate of immunity from wart disease is granted for a variety only after successful resistance for at least two successive years.

Lists are given showing immune and susceptible varieties.

Wart disease of potatoes, G. C. GOUGH (*Jour. Roy. Hort. Soc.*, 45 (1920), No. 2-3, pp. 301-312).—This is a short account, with bibliography, of the history, distribution, and effects of potato wart disease (*Synchytrium endobioticum*), the discovery of immunity thereto, and the probable future of the disease and of the potato industry.

[Sugar cane disease], H. P. AGEE (*Hawaii. Sugar Planters' Assoc., Rpt. Expt. Sta. Com.*, 1920, pp. 18-21).—In this portion of the director's report information is given pertaining to sugar cane yellow stripe, root rot, eye spot, and Pahala blight on areas specified.

Sugar cane root disease investigations (*Jour. Dept. Agr. Porto Rico*, 4 (1920), No. 1, pp. 3-46, figs. 9).—This includes three contributions noted below:

Sugar cane root disease, F. S. Earle (pp. 3-27).—It is considered safe to say that one or another form of the troubles known under the collective name of root disease is causing a loss of tonnage on every acre of cane now growing in Porto Rico. Recent discoveries have shown the advisability of reviewing this entire problem. The symptoms are briefly noted.

The trouble appears to be complex, including phases designated as root rot, wither tip, top rot, and rind disease. These phenomena are said to be caused by a number of facultative parasites, none of which attack tissues which are vigorous and are growing actively. A hitherto unknown true parasite has also been found to inhabit the vascular bundles. *Rhizoctonia* and *Pythium* are the usual root-killing agents rather than *Marasmius* and *Himantia*.

Cane varieties differ greatly as regards their resistance to root disease. The Otaheite or Caña Blanca is very susceptible. North Indian canes like Kavangire and canes derived partly from North Indian parentage are very resistant or practically immune. Remedial or preventive measures include the planting of resistant varieties, cultural methods to overcome facultative parasites, proper seed selection, and careful handling.

Investigations of root disease of sugar cane, J. Matz (pp. 28-40).—A study of the organisms associated with sugar cane root disease showed the presence of fungi belonging to the genera *Rhizoctonia* and *Pythium*, both of which are common in the soils of Porto Rico. More than one form of *Rhizoctonia* has been isolated from diseased cane roots.

A new vascular organism in sugar cane, J. Matz (pp. 41-46).—In the course of the studies above noted the root vessels were sometimes found to be clogged

with an organism which was classed as a new fungus and is described under the name *Plasmodiophora vascularum* n. sp.

The control of sweet potato diseases, T. F. MANNS (*Peninsula Hort. Soc. [Del.], Trans.*, 34 (1921), pp. 77-80).—Early experiences and observations leading to the belief that sweet potatoes when properly handled are reasonably secure from sick soil conditions have been reversed after observing such areas for a long period of time. Experimentation with five areas which had become soil sick after 6 to 10 years of consecutive potato cropping shows a reduction of crop amounting to 75 per cent in some cases. Many soil sick areas are said to exist on the peninsula.

On areas sick with vine wilt or yellows none of the present commercial varieties which have been tested give promise of economic yields, though some very good crops of yams have been produced. These sick soil conditions are produced by specific diseases, common among which are vine wilt or yellows (*Fusarium conglutinans*), pox pit or soil rot (*Cytospora batata*), soil stain (*Monilochaetes infuscans*), and black rot (*Sphaeronema fimbriatum*), several other fungi being regarded as less important.

Black rot has been found to be controllable through the practice of careful seed selection and treatment with corrosive sublimate, followed by bedding in clean soil.

Important progress has been made in the control of storage rots of sweet potatoes through the use of houses properly constructed for top and bottom ventilation and more uniform temperatures. The plan of kiln drying the roots at high temperatures to produce immunity to rot resulted in the production of tiny buds or sprouts which were sensitive to attack by this disease. It was found that the kiln-drying process could be completed under a temperature of 70° and with a humidity ranging from 50 to 70 per cent. It has been found possible by keeping up this treatment for three or four weeks under favorable weather conditions to complete kiln drying without the suffocating effects of close ventilation, and the losses have been greatly reduced.

A danger to the culture of tobacco in Deli, B. T. PALM (*Bul. Deli Proefsta. Medan*, No. 14 (1921), pp. 9).—A short list of tobacco diseases in Deli (which are said to be, generally speaking, the same as those in central Java) concludes with the statement that a typical *Oidium* noted as attacking tobacco in Java has not yet appeared in Deli, but that a disease due to an *Oidium* has been noted on native tobacco on the high central plateau of Sumatra. The conidial stage, only, of this fungus has been found. The fungus is said to answer in general to the description usually given of the conidial stage of *Erysiphe cichoracearum*.

A treatment for tomato wilt on trial, W. A. BIRMINGHAM (*Agr. Gaz. N. S. Wales*, 32 (1921), No. 3, p. 212).—A tomato-wilt treatment, employing ammonia solution for watering the soil and a potassium nitrate solution for spraying the leaves, gave no perceptible control for tomato wilt. The cost also is prohibitive.

Silver leaf disease (*Jour. Roy. Hort. Soc.*, 45 (1920), No. 2-3, pp. 313-315).—This is an account, drawn up under the direction of the Council of the Royal Horticultural Society from observations of the staff at Wisley and from the literature of the disease (mainly published in England, where nearly all of the experimental work has been done), regarding fruit tree silver leaf disease. Information is given in very condensed form regarding the symptoms, nature, cause, and range of the disease, trees liable thereto, the fruiting of the fungus, the infection of the trees, and preventive measures, including the destruction of all diseased material.

Apple canker: Two centuries' practice in its control, E. R. SWALES (*Jour. Pomol.*, 2 (1921), No. 4, pp. 271-273).—Citing accounts and advice regard-

ing apple canker (*Nectria ditissima*) appearing as early as 1700, and emphasizing differences in resistance of varieties, the author adds his own observations, particularly on a highly susceptible variety.

The terms winter and summer fruiting stages of this fungus are misleading. On May 14, 1921, conidia of *N. ditissima* were found on cankered shoots. This helps to prove that the two stages of spore production, conidial and ascigerous, are not entirely seasonal, as one or another may occur under favoring conditions at almost any season. Thus it is safer to assume that canker may be infectious throughout the year, and that the clean removal of every canker spot is the best method of control.

Apple tree anthracnose, H. P. BARSS (*Oreg. Bd. Hort. Bien. Rpt.*, 16 (1919-20), pp. 127-130, figs. 2).—Apple tree anthracnose, the most serious canker disease in western Oregon, has caused premature destruction of many promising orchards, but this disease may be held in check by spraying with Bordeaux mixture in the fall just after the crop has been harvested. It is advisable, however, to use a first spray before the fall rains set in. Thorough spraying is necessary to protect the bark perfectly during the period of dormancy on account of sensitivity to infection.

Nothing has been found superior as an early spray to a weak Bordeaux mixture, or as a late spray to the full 6:6:50 Bordeaux. The cankers are known to continue the production of spores during two or three seasons.

Success in apple scab control, H. P. BARSS (*Oreg. Bd. Hort. Bien. Rpt.*, 16 (1919-20), pp. 114-117, figs. 3).—A review of orchard practices in Oregon, looking to control of apple scab, emphasizes the success in control attained in the Hood River region, which has a climate favorable to scab, by growers who have adopted a program involving four or five sprays for scab control, two of these being combination sprays for protection from the codling moth. The critical spraying is the delayed dormant or early cluster application. Under the climatic conditions prevailing in western Oregon, scab spores are discharged as early as February from fungi carried over in old leaves and are present in the air ready to infect the tender leaf tips as they emerge from the bud scales.

The capacity of the spray outfits is important. The tops of the rapidly growing trees are often imperfectly sprayed on account of the trouble involved in spraying from the top of the tank or from towers.

The addition of iron sulphate to lime sulphur after the latter has been put into the tank results in chemical action, which does not destroy the effectiveness of the application, but turns it black, so that the character of the spray (as coarse or fine) and the exact efficiency of the nozzle are readily apparent.

Sooty blotch of pomaceous fruits, A. S. COLBY (*Ill. State Acad. Sci. Trans.*, 13 (1920), pp. 139-175, pls. 12).—The results presented in this article are considered to indicate that the apple sooty blotch organism, known by different names, which are indicated, belongs in a new genus, which is erected under the name *Gloeodes*, this species being designated as *G. pomigena* n. comb.

The blotch, which is commercially important, is entirely superficial, causing no rot or malformation. It attacks under favorable conditions all varieties examined. The thallus types have been studied and are described. It is argued that fly speck and sooty blotch are not identical. Sooty blotch is controlled by orchard management, it does not spread appreciably in storage, and it is easily removed from the surface of apple fruits by immersion for a short time in Javelle water.

The annotated bibliography includes contributions covering the period from 1832 to 1919.

The control of brown rot in fruits, W. C. DUTTON (*Michigan Sta. Quart. Bul.*, 4 (1921), No. 2, pp. 53-55).—The author reports on experimental work

carried on during two seasons for the control of rot on plum and peach trees, as well as to prevent its development on the fruit in shipment or in storage. The material used consisted of sulphur dust and lime-sulphur solution. Either material was found to control brown rot on the trees, but to control it after harvesting it was found necessary to make an additional application of sulphur dust a week or 10 days before the fruit was harvested.

Experiments with Lombard plums treated in this way showed that the fruit remained in good condition 10 days longer than that sprayed one month before harvesting. Wark peaches dusted just before harvesting showed 90 per cent sound fruit after having been picked 5 days, while those not dusted had 82 per cent of fruit infected with brown rot in the same time. Similar results were obtained with other varieties of peaches and plums.

On the basis of the results of these experiments, the author recommends spraying soon after the blossoms have dropped with a poison alone or with a fungicide, the second application of a poison and fungicide about two weeks after the first, a third application to consist of a fungicide to be applied one month before the fruit ripens, and dusting with sulphur 10 days before harvesting.

Biochemistry of plant diseases.—IV, Effect of the brown rot fungus on plums, J. J. WILLAMAN and F. R. DAVISON (*Abs. in Science, n. ser.*, 54 (1921), No. 1401, p. 445).—Two varieties of plums resistant to brown rot, and two non-resistant, were picked at three stages of maturity and subjected to analysis before and after rotting by *Sclerotinia cinerea*. It was found that the ash, nitrogen, calcium oxid, ether extract, and crude fiber were consistently higher in the rotted samples. The resistant varieties contained much more crude fiber but less of the other constituents than the nonresistant varieties, and it is believed that the quality and quantity of the structural elements are important factors in resistant properties.

Peach disease control, J. A. McCLINTOCK (*Georgia Sta. Bul.* 139 (1921), pp. 30, figs. 6).—From a study of losses due to insects and diseases in commercial peach orchards in Georgia in 1920 and 1921, the author is led to the conclusion that peaches can not be protected from curculio and brown rot by the use of sprays or dusts alone. The control of brown rot is said to be dependent upon the control of curculio. Mummied fruit left on the trees and twig cankers are considered important sources from which conidia of the brown rot fungus are disseminated. Tests conducted in a commercial orchard proved the value of sprays and dusts, but were not conclusive as to which combination was the best for use on the different varieties of peaches included in the tests. When the cost of both labor and material were taken into consideration there was said to be little difference between the cost of liquid sprays and dusts.

Data collected during the past two years are said to indicate that peach orchards must be thoroughly cleaned after the harvesting of the fruit.

A disease of coconut trees, L. A. CATONI (*Porto Rico Dept. Agr. and Labor Sta. Circ.* 43 (1921), *Spanish ed.*, pp. 3-7).—A description is given of a coconut bud rot which is said to occur in a number of the West Indian islands, but thus far has not been reported in Porto Rico.

Orange diseases, G. GÁNDARA ([*Mex.*] *Sec. Agr. y Fomento, Dir. Agr. Bol.* 111, n. ser. (1920), pp. 40, pls. 52).—This is a compilation of animal and vegetable parasites of orange in connection with remedial measures.

The celworm disease of daffodils (*Agr. and Hort. Soc. India, Proc.*, 1920, Jan.-June, pp. 23-30).—This contains an outline, with discussion, of the work and reports of Ramsbottom previously noted (*E. S. R.*, 43, pp. 247, 350; 44, p. 451), also of a lecture regarding control of the nematode disease of Nar-

cissus. This trouble is successfully treated by keeping the diseased bulbs for three hours in water at 110° F. If the treatment is carried out during July-September the bulbs suffer no ill effects therefrom.

The nematodes enter, not through the roots, but by way of the young leaves as they push through the soil.

The larch needle-cast fungus, *Meria laricis*, W. E. HILEY (*Quart. Jour. Forestry*, 15 (1921), No. 1, pp. 57-62, pl. 1, fig. 1).—A fuller account is given of the larch needle-cast fungus (*M. laricis*) than was included in the author's book previously noted (E. S. R., 44, p. 347). There is also a brief account of studies on this disease.

Higher Basidiomycetes from the Philippines and their hosts, I-IV, O. A. REINKING (*Philippine Jour. Sci.*, 15 (1919), No. 5, pp. 479-490; 16 (1920), Nos. 2, pp. 167-179; 5, pp. 527-537; 17 (1920), No. 4, pp. 363-374).—Results are given of attempts to collect the higher Basidiomycetes from known hosts in localities indicated. The vast majority of these fungi that are found on dead wood are not confined to specific hosts. In this respect they contrast sharply with the parasitic forms which are more apt to be confined to definite hosts.

The collections have been made with special reference to the identity of the host plants. Numerous very important timber-destroying forms are included.

Fungi injurious to paints, C. M. HAENSELER (*New Jersey Stas. Rpt.* 1920, pp. 605-607).—A brief account is given of investigations conducted to determine the prevalence of fungi attacking paints, the nature of the injury, conditions necessary for their development, control measures, etc.

The author reports *Dematium pullulans*, several species of *Cladosporium*, two species of *Phoma*, and an unidentified fungus causing discoloration on painted surfaces, with *Cladosporium* and *Aspergillus* causing considerable injury to varnished surfaces.

Experiments made to determine the source of food of the paint-inhabiting fungi showed that the fungi were unable to derive their full nourishment from the oil in the paint, and it is believed that they derive some of their nourishment from foreign matters which happens to be on the paint.

Panel tests were conducted to determine the relative growth of fungi on the various types of paint, the panels being exposed under various conditions for from 6 months to 3 years. It was found that lithopone was readily subject to fungus attack. Next to lithopone, pure white lead was the most subject to attack, while zinc oxid and mixed paints showed only occasional colonies.

Some experiments were carried on to determine the possibility of preventing the growth of fungi on paints by means of adding antiseptics and poisons to the paints. Various proportions of copper sulphate, benzol, corrosive sublimate, zinc chlorid, and carbolic acid were added to the second coat of paint before its application. Somewhat less growth was observed on paints treated with copper sulphate and corrosive sublimate, but the tests are believed to indicate that antiseptics and fungicides added directly to paints are not especially effective.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

Wild life resources of Louisiana; their nature, value, and protection, H. H. KOPMAN (*La. Dept. Conserv. Bul.* 10 (1921), pp. 164, pl. 1, figs. 36).—This work calls attention to the exceptional value and unique character of Louisiana wild life, the natural divisions of Louisiana and their relation to wild life, the distribution and use of conspicuous and important forms of wild life, and kinds of wild life requiring protection and means of providing it. An appendix lists birds of accidental or doubtful occurrence in the State.

Moisture and altitude as factors in determining the seasonal activities of the Townsend ground squirrel in Washington. W. T. SHAW (*Ecology*, 2 (1921), No. 3, pp. 189-192, figs. 2).—This paper deals with *Citellus townsendi* Bach., which now inhabits the Snake and Columbia River regions of eastern Washington. It appears that the activities of this animal are controlled to an unusual degree by such climatic conditions as high temperature and lack of moisture.

The Migratory Bird Treaty Act (*U. S. Dept. Agr., Dept. Circ. 202* (1922), pp. 6).—This consists of the ruling of the court and the charge to the jury, with a syllabus thereof by R. W. Williams, in the United States District Court for the Northern District of Georgia, in November, 1921, on an indictment charging hunting, killing, and possession of mourning doves in violation of the Migratory Bird Treaty Act of July 3, 1918, in which the defendant was found guilty and fined. It was decided that since the treaty declares that doves are migratory, where the evidence fails to establish that they or any distant variety of them are clearly nonmigratory it is established as a matter of law that they are migratory birds within the meaning of such treaty, and in a prosecution for hunting or killing mourning doves in violation of this act the question whether the mourning doves hunted or killed may have been resident in any particular State can not be heard by a jury.

Natural history of the Trochilidae (synopsis and catalogue), E. SIMON (*Histoire Naturelle des Trochilidae (Synopsis et Catalogue)*. Paris: L. Mulo, 1921, pp. 416).—The first part of this work (pp. 1-244) consists of a synopsis of the family Trochilidae, or humming birds, which is divided into 46 groups or series. The second part (pp. 245-407) consists of a catalogue of the family.

Canary culture for amateurs, E. BRUNSKILL (*London: F. Carl, 1920, pp. IX+115, figs. 23*).—This is a popular account.

Canary breeding for beginners, C. ST. JOHN (*London: F. Carl, [1920], rev. ed., pp. 83, figs. 15*).—This is a popular account.

Yorkshire canaries: How to breed, manage, and exhibit, H. W. BATTYE (*London: Cage Birds, 1919, pp. 80, pls. 4, figs. 6*).—This is a popular account.

Fourth biennial report of the Montana State Board of Entomology, R. A. COOLEY (*Mont. State Bd. Ent. Bien. Rpt., 4* (1919-20), pp. 44, fig. 1).—In the first part of this report the State entomologist deals with the work conducted during 1919 and 1920, which was devoted almost exclusively to the eradication or control of the spotted fever tick *Dermacentor venustus* Banks in western Montana. This is followed by a Report of Tick Control Operations in the Bitter Root Valley During the Seasons of 1919-1920, by R. R. Parker (pp. 18-44).

Report of the department of entomology, T. J. HEADLEE (*New Jersey Stat. Rpt. 1920, pp. 415-554, pls. 2, fig. 35*).—A list is first given of 170 species of insects, inquiries relating to which were received during the year. Brief accounts of the occurrence of the more important insects of the year are next presented. Under the heading of investigations, the author deals with the pear psylla (pp. 430-432), the codling moth (pp. 433-440), and insecticidal dusts (pp. 440-461).

Work with the pear psylla was continued along the lines of the previous year (E. S. R., 44, p. 349), particular emphasis being placed on summer treatment. The investigations of this pest for the past five years have led to the following conclusions: "Scraping the rough bark from the trees during dormancy has little effect on abundance of the psylla during the following year. Dormant-season treatment with soluble oil markedly reduced the number of psylla during the fore part of the growing season following. Dormant-season treatments given when the weather is warm enough for psylla to jump and

fly are largely a waste of time and material. Dormant-season treatments given only when the psylla are found hanging to the twigs and small branches too stiff with cold to move are much more effective than those given at other times. Coating the trees with standard liquid-lime sulphur, 1 gal. to 9 gal. of water, appears to destroy every psylla egg hit and to afford protection to the tree during blossoming, setting, and early growth. Coating the undersides of the foliage with standard liquid-lime sulphur (33° Beaumé), 1 gal. to 40 gal. of water, whenever the droplets of honeydew appear on the undersides of the leaves, appears so to reduce the developing brood as practically to eliminate the damage which that brood would otherwise do. Standard liquid-lime sulphur at the strength recommended for coating the undersides of the foliage will, if applied in hot weather, scorch or burn severely both foliage and fruit. Self-boiled lime sulphur may be substituted for the standard liquid, will not burn, but requires more thorough application than the standard liquid. It is possible, but not yet sufficiently proven, that higher dilutions of the standard liquid such as 1 gal. to 60 gal. of water may do as a substitute for the greater strength (1 gal. to 40 gal. of water) when the weather is too hot to render the application of the latter advisable. When codling moth is very serious each summer, spray for psylla until the fruit is picked should incorporate powdered arsenate of lead at the rate of 1.5 lbs. to each 50 gal."

The work with the codling moth during the year involved a continuance of the brood study commenced in June, 1919. A diagram is given which shows the time of emergence of broods and the entering of the larvae. A report of observations has been previously noted (E. S. R., 43, p. 357). This pest is at present tremendously abundant in the Glassboro and Maple Shade areas. Many orchardists in these areas are failing to get control, while some are getting good control. There were two distinct broods in these areas in 1919, a large percentage of the first brood appearing to enter the blossom end, as has usually been found to be the case. The present spraying is universally successful in controlling blossom-end injury, but in order to obtain control it is absolutely essential that the spraying be done during the period of the entry of side worms of the first and second broods. "The secret of control of side worms of the first and second broods appears to lie in keeping the fruit and foliage coated during the periods of entry. Lead arsenate, all things considered, is the best insecticide for codling moth. While it is possible to administer a more complete coating of fruit and foliage with dust than with spray, it is not nearly so effective because it does not stick as well as spray and leaves the fruit uncovered for a longer portion of the time."

Work with insecticidal dusts during the 7-year period beginning with 1913 is reviewed. This work has led the author to consider the following conclusions to be justified: "The lead-arsenate-sulphur-lime dust is a satisfactory substitute for self-boiled lime sulphur for the control of curculio, scab, and brown rot of the peach. The lead-arsenate-sulphur dust, in view of its relative failure to effect control of the codling moth and plum curculio, can not be considered a satisfactory substitute for present well-known sprays in the control of these insects on apple. In view of the great need of a more complete coating of fruit and foliage than can be realized by the use of the dust, a thorough investigation which will result in forms of dust that will stick to fruit and foliage of apple quite as well as or better than liquid mixtures should be undertaken and prosecuted with utmost vigor." A discussion of the subject by the author has been noted from another source (E. S. R., 45, p. 254).

A preliminary report on the use of new mechanical protectors for the control of the peach borer, by A. Peterson, is next presented (pp. 461-468). The use of

the tar-paper collar, known as Scott's protector, having failed to reduce the infestation more than 40 to 60 per cent during a period of three years led to the conception, by the entomologist, of the protector here described, which includes a trough that the larvae have to cross before they reach the tree, in which repellants may be placed. These protectors give promise of materially reducing or preventing a peach-borer infestation provided they are properly adjusted about the tree and tightly sealed for the entire season from June 15 to September 15.

An account of the strawberry rootworm [*Typophorus* (or *Paria*) *canellus* Fab.], a serious pest on roses in the greenhouse, by A. Peterson (pp. 468-493) follows. This pest has been found in only one rose greenhouse in New Jersey, namely, at Summit, but has been reported by Weigel and Chambers to occur in a number of rose houses near Philadelphia (E. S. R., 43, p. 362). Its greatest injury at Summit took place during the summers of 1917 and 1918, when the leaves of Ophelia, Russell, and Hoosier Beauty roses in the greenhouse were badly riddled and the young shoots severely scarred by the adults. The adults of *T. canellus* in New Jersey have been found outdoors feeding on strawberries, raspberries, blackberries, and rose bushes, while the larvae have been found on strawberries. The studies at Summit led to the preparation of a chart showing the relative abundance of the adults on the bushes, which indicates the presence of two generations each year, the second generation always being smaller than the first. Descriptions and illustrations are given of the several stages of the beetle. Control measures reported upon include fumigation, sprays, dust, and soil treatment.

Cranberry investigations, by C. S. Beckwith (pp. 493-505) follow, of which three pages (pp. 503-505) relate to cranberry insects. The cranberry blossom worm was the source of serious injury for the first time. Reflooding of the bog for a period of 24 hours soon after the earliest buds begin to show color and the pest appears is said to give control. A diagram is given showing the effect of flooding upon this pest. Tests were made of sodium cyanid as a control measure for the cranberry girdler, which often attacks the higher and well-drained portions of bogs, leaving the lower portions almost untouched, thus often being out of reach of ordinary flooding operations. While a solution consisting of 1 oz. of sodium cyanid to 25 gal. of water, applied at the rate of 1 gal. to the square foot, killed all the girdlers in experiments it was found that in the field a mat of dead leaves on the surface prevented a uniform wetting of the ground surface, and an application followed the course the rain water had made, running off at one point.

The mosquito-control work conducted during the year is reported by T. J. Headlee and M. Carroll (pp. 507-554) under the headings of experiment station control work (pp. 507-519), county mosquito commission work (pp. 520-543), a summary of the year's work (pp. 543-547), the present status of mosquito control in New Jersey (pp. 548, 549), new devices (p. 550), the future of mosquito-control work in New Jersey (pp. 550-553), mosquitoes of the year (pp. 553, 554), and New Jersey Mosquito Extermination Association (p. 554).

Insect pests (*West Indian Bul.*, 18 (1920), No. 1-2, pp. 39-60; 19 (1921), No. 1, pp. 20-31).—These are reports on the prevalence of the more important insects in the West Indies during 1918 and 1919.

Annual report on the division of entomology for the year ending March 31, 1918, T. J. ANDERSON (*Brit. East Africa Dept. Agr. Ann. Rpt.*, 1917-18, pp. 37-98).—The first part of this report is devoted to an extended account of the coffee bug *Antestia lineaticollis* Stal., its life history, natural enemies, and means of control (pp. 38-80). This is followed by brief accounts of insects

attacking citrus, insects affecting stock, and the cultivation of silk, and by the Imperial Institute report on Eri silk from British East Africa, and a report on 24 tubes of fleas from Mombasa.

Reports of the grain pests (war) committee (*Roy. Soc. [London], Grain Pests (War) Com. Rpts., 1921, Nos. 9, pp. 52, figs. 15; 10, pp. 16*).—Papers presented in the ninth report include a Note on the Hymenoptera Parasitic on Beetles Infesting Grain, by E. S. Goodrich (pp. 5-7); Report on Parasitic Hymenoptera Bred from Pests of Stored Grain (including a bibliography of 60 titles), by J. Waterston (pp. 8-32); and Insects Associated with Grain, etc., by J. H. Durrant (pp. 33-52).

The tenth report, by W. A. Herdman et al., is the final report to the council of the Royal Society and the Ministry of Agriculture and Fisheries on the work of the grain pests (war) committee.

The cotton boll weevil and pink bollworm, L. A. CATONI (*Porto Rico Dept. Agr. and Labor Sta. Circ. 41 (1921), Spanish ed., pp. 3-8*).—This is a popular summary of information on these two important enemies of cotton, the latter of which has recently become established in Porto Rico.

The minor sugar-cane insects of Porto Rico, G. N. WOLCOTT (*Jour. Dept. Agr. Porto Rico, 5 (1921), No. 11, pp. 46, figs. 19*).—Brief accounts are given of the insects of minor importance as enemies of sugar cane in Porto Rico, particular mention being made of the West India cane fly or leafhopper (*Delphax (Stenocranus) saccharivora* Westw.), the sugar-cane leafhopper of Porto Rico (*Kolla similis* Walk.), and several other leafhoppers.

Insect pests of dates and the date palm in Mesopotamia and elsewhere, P. A. BUXTON (*Bul. Ent. Research, 11 (1920), No. 3, pp. 287-304, pl. 1, fig. 1*).—This is a report of investigations made by the author commencing in July, 1918, following a sudden drying up and falling off of dates in June where previously there had been every prospect of a complete crop. The principal pest was found to be the larva of a gelechiid moth that had finished its work and left the palms to pupate. During the course of the investigation all the important date-growing areas of Mesopotamia were visited and insect pests of date palms studied. The results of the author's studies are here presented, together with a review of the literature and a bibliography of 38 titles.

[Insects affecting forests] (*[Gr. Brit.] Forestry Comn. Leaflets, 1 (1920), pp. 12, figs. 5; 2 (1921), pp. 3, fig. 1; 3, pp. 8, figs. 4; 4, pp. 4, figs. 3; 7, pp. 7, figs. 4*).—These leaflets deal, respectively, with pine weevils, *Chermes cooleyi* Gill., the pine shoot beetle (*Myelophilus piniperda* L.), the black pine beetle (*Hylastes ater* Payk.), and Chermes attacking spruce and other conifers.

The silver fish (Lepisma spp.), E. McDANIEL (*Michigan Sta. Quart. Bul., 4 (1921), No. 2, pp. 62-64, fig. 1*).—This is a brief account of the habits and control of the silver fish, which has been studied at the station. It is pointed out that there are two species common in the northeastern United States, namely, *L. saccharina* which seems to prefer starches and sugar and is usually found in damp places and *L. domestica* which has been reported as also feeding on animal products such as glue and leather and is specially fond of warm places. The author's investigations have led to the conclusion that powders are the most effective and easiest remedies to apply in most cases. Of a number of different ingredients tried, the three which have given the best results are pyrethrum, borax, and sodium fluorid. Sodium fluorid is preferred by the author where it is possible to use it, since it works quickly and the powder retains its strength permanently.

The termites of Porto Rico, G. N. WOLCOTT (*Porto Rico Dept. Agr. and Labor Sta. Circ. 44 (1921), Spanish ed., pp. 3-14, figs. 12*).—A brief account of

the termites which occur in Porto Rico, of which *Nasutitermes* (*Eutermes*) *morio* Latr. is the common species. *Cryptotermes brevis* Walk. is an important and destructive species.

On the orthopterous group *Phaneropterae* (=Scudderiae), with descriptions of a new genus and species, A. N. CAUDELL (*Jour. Wash. Acad. Sci.*, 11 (1921), No. 20, pp. 487-493, fig. 1).

Observations of cotton thrips in the Gezira, Blue Nile Province, Sudan, in 1918-19, G. H. CORBETT (*Bul. Ent. Research*, 11 (1920), No. 2, pp. 95-100).—This is a report of studies of *Heliothrips indicus* Bagn., which has been known on the Gezira cotton for about three years and is popularly called "dry asul." It is the most important pest with which the cultivators of cotton in the Gezira have to contend, the injury being caused by its attack upon both surfaces of the leaves.

Chrysomphalus dictyospermi, or the red scale of citrus, F. SILVESTRI (*R. Lab. Ent. Agr., R. Scuola Super. Agr., Portici, Circ.* 2 (1921), pp. 11, figs. 14; *abs. in Rev. Appl. Ent.*, 9 (1921), Ser. A, No. 7, p. 343).—An account of *C. dictyospermi*, its occurrence and control measures in Italy, where it has greatly increased in recent years in the Provinces of Naples and Caserta.

A descriptive catalogue of the scale insects (Coccidae) of Australia, III, W. W. FROGGATT (*N. S. Wales Dept. Agr., Sci. Bul.* 19 (1921), pp. 43, figs. 23).—This third part of the catalogue previously noted (*E. S. R.*, 45, p. 456) deals with the subfamilies Idiococcinae, Tachardinae, and Monophlebinae. The new genus *Pseudopsylla* is erected and five species described as new.

Control of cattle lice, E. K. SALES (*Michigan Sta. Quart. Bul.*, 4 (1921), No. 2, pp. 61, 62).—This is a brief account, in which the reader is referred to U. S. D. A. Farmers' Bulletin 909 (*E. S. R.*, 38, p. 764) for further information.

A liparid moth (*Ocnerogyia amanda* Staud. destructive to figs in Mesopotamia, P. A. BUXTON (*Bul. Ent. Research*, 11 (1920), No. 2, pp. 181-186, pl. 1, fig. 1).—This is a report of studies in 1918 of the life history and habits of *O. amanda*, the larva of which devoured all the fig leaves with the exception of one or two large vascular bundles and caused the fruit to shrivel and drop before it was ripe.

A new grass pest of the Atherton Tableland, A. P. DODD (*Queensland Agr. Jour.*, 16 (1921), No. 2, pp. 79-81).—The larvae of the hepialid moth *Oncopera mitocera* Tur. are a source of serious damage to pastures in North Queensland, possibly only in the Cairns district. The paper includes a description of its stages, an account of its life history and habits, natural enemies, means of control, etc.

The brown hardback grub in Antigua (*Lachnosterna antiquae* Arr.), H. A. BALLOU (*West Indian Bul.*, 19 (1921), No. 1, pp. 1-17).—This grub was entirely unknown in Antigua until about 1911, when it was found to be responsible for the failure of sugar-cane cuttings to grow when planted. It was afterwards observed in connection with growing and ripening canes that were diseased, or stunted, or had died. At the end of 1911 a field of onions was entirely destroyed by it, and since that time it has been recognized also as a pest of Indian corn, sweet potatoes, and yams. In the present paper the author records field observations of the pest, together with notes on its life history.

The campaign against *Phytalus smithi* in the colony of Mauritius, H. A. TEMPANY and D. D'EMMEREZ DE CHARMOY (*Bul. Ent. Research*, 11 (1920), No. 2, pp. 159-169, pl. 1).—This is an account of the campaign which has been in progress against *P. smithi* during the past 8½ years.

Studies of rhinoceros beetles as enemies of the coconut palm, K. FRIEDERICHs (*Monog. Angew. Ent.* No. 4 (1919), pp. IV+116, pls. 21, figs. 2).—In the

first part of this report of his studies (pp. 3-15) the author considers the morphology of *Oryctes rhinoceros* L., its ecology and the ecology of other species of the genus. In the second part (pp. 15-74) the nature of its injury, its occurrence in Samoa, the Philippines, Cochin China and Cambodia, Siam, the Straits Settlements and the Federated Malay States, and Ceylon; and the occurrence of *O. monoceros* Ol. and *O. boas* F. in east Africa and of *O. radama* Coq. and *O. boas* in Madagascar are considered. Part 3 (pp. 75-112) reports upon observations of the fungus parasite *Metarrhizium anisopliae* and other natural enemies of *O. rhinoceros* and of other natural checks on their increase.

A list of 63 references to the literature is included.

Bark beetles of the genus *Sphaerotrypes*, C. F. C. BEESON (*Indian Forester*, 47 (1921), No. 12, pp. 514-518).—This is a brief preliminary account of studies of the classification and economic importance of the Indian species of scolytids of the genus *Sphaerotrypes*.

The specific names of two otiorhynchid weevils of Florida, E. A. SCHWARZ and H. S. BARBER (*Ent. Soc. Wash. Proc.*, 24 (1922), No. 1, pp. 29, 30, figs. 2).

Notes on the food plants and distribution of certain billbugs, A. F. SATTERTHWAIT (*Ecology*, 2 (1921), No. 3, pp. 198-210, fig. 1).—This is a report of observations made during the course of investigations of North American billbugs of the genus *Calendra* (*Sphenophorus*) by the U. S. D. A. Bureau of Entomology. The notes presented on 9 forms are exclusive of those on 11 species previously noted (*E. S. R.*, 40, p. 655).

Macedonian ants; observations of their habits, F. DOFFLEIN (*Mazedonische Ameisen; Beobachtungen über ihre Lebensweise*. Jena: Gustav Fischer, 1920, pp. 74, pls. 8, figs. 10).—This is a report of observations of the bionomics of Macedonian ants, of which the author collected 36 species and subspecies during the years 1917 and 1918.

Introduction of *Aphelinus mali* Hald. into France, P. MARCHAL (*Rev. Hort. Algérie*, 25 (1921), No. 5, pp. 94-96).—This is a brief account of the work of introducing this parasite of the woolly apple aphid into France, first commenced in the spring of 1919.

A morphological study and comparison of the mouth parts of some Hymenoptera, G. W. ALBERTSON (*Diss., Catholic Univ. of Amer., Washington, D. C.*, 1921, pp. 59, figs. 22).—This is a comparative study of the mouth parts of *Vespa maculata* L. (worker), *Apis mellifica* L. (worker), *Andrena perplexa* Smith (female), and *Macremphytus varians* Nor. (female).

Five species of tsutsugamushi (the carrier of Japanese river fever) and their relation to the tsutsugamushi disease, M. NAGAYO ET AL. (*Amer. Jour. Hyg.*, 1 (1921), No. 5-6, pp. 569-591, pls. 8, fig. 1).—Descriptions are given of five species of mites of the genus *Trombicula*. They differ morphologically as well as biologically from each other and never show any transition forms. Only one of these species, *T. akamushi* Brumpt, is known to be concerned in the transmission of human tsutsugamushi disease. A bibliography of 17 titles is included.

FOODS—HUMAN NUTRITION.

Food chemistry problems, E. EICHWALD (*Probleme und Aufgaben der Nahrungsmittelchemie*. Dresden: Theodor Steinkopff, 1921, pp. VIII+101, figs. 2).—This is a brief survey of some of the present problems in food chemistry with suggestions as to methods for their solution as noted in German literature. Among the subjects discussed are the significance of the different amino acids in nutrition, the biological differences in various fats with methods for their identification, vitamins, biological criteria for milk, the significance

of H-ion concentration, the application of colloidal chemistry to food chemistry, and the preparation of synthetic foodstuffs.

Variation in moisture content of flour during storage, R. S. HERMAN and W. HALL (*Jour. Amer. Assoc. Cereal Chem.*, 6 (1921), No. 3, p. 10).—This is a report of the results obtained over a period of one month from the date of milling on the same sample of flour, stored in a cotton sack and thoroughly exposed to the air.

The logarithmic nature of thermal death time curves, W. D. BIGELOW (*Jour. Infect. Diseases*, 29 (1921), pp. 5, pp. 528-536, figs. 6).—The author describes a method of representing thermal death time relations by the use of semilog paper instead of coordinate paper as in the previous report (E. S. R., 45, p. 10). The last positive reading and the first negative reading for each organism at different temperatures are entered on semilog paper, and a straight line is drawn through the greatest possible number of pairs of observation points. With few exceptions, lines so drawn pass through all pairs of readings for each organism and the curves are nearly parallel. Curves for 12 different thermophilic organisms and an average curve for 15 are given. The latter is logarithmic between 105 and 125° C. Above and below these temperatures the curve does not intercept the observation points. It is thought that the discrepancies above 125° may be due in part to the rate of heat penetration to the center of the tube.

The logarithmic nature and parallelism of the curves of the different organisms studied suggest a method of determining the thermal death time curve of a given bacterium by the use of a type curve of the proper slant. The time necessary to destroy a certain number of spores may be determined, and the last positive and the first negative results entered on semilog paper. A line drawn through these points parallel to the type curve fixes the thermal death time curve for the organism between 105 and 125°.

This method of representing thermal death times is found to be applicable also to nonspore-bearing bacteria, and while straight lines drawn through pairs of observation points do not intercept as closely as in the case of the thermophiles studied, there is sufficient evidence to show that the curves of nonspore-bearing bacteria are also logarithmic. The author believes that logarithmic curves show more accurately than coordinate curves the relations of the thermal death times at different temperatures.

Food and nutrition, including an examination of the climatic factor, C. E. CORLETTE (*Sydney: N. S. Wales Bd. Trade*, 1921, pp. 71, fig. 1).—This publication, which was written at the request of the New South Wales Board of Trade, presents in a concise manner the essential facts in our present knowledge of food requirements, with abstracts from the authorities quoted. Particular attention is given to conditions in New South Wales, especially in regard to the relation of the dietary to climatic conditions.

As definite suggestions for dietary standards, the author recommends that the man value be obtained by Lusk's coefficients, and he sets as the calorie standards per man per day 3,300 calories "as purchased" for moderate work, 2,800 for light work, and 2,300 for sedentary occupation. The protein requirement is set at a total animal protein of 45 gm. per day "as purchased," not less than 10 gm. of this to be milk protein. While the total protein is estimated at from 80 to 100 gm., it is considered unnecessary to figure this if the animal protein proportioned as above covers 45 gm. It is recommended that fat supply 25 per cent of the total calories up to 2,300 and 30 per cent of the extra calories above 2,300.

The gateway to health, edited by C. E. HECHT (*London: Food Ed. Soc.*, 1921, pp. VIII+434, figs. 2).—This volume, which has to do with the preven-

tion of diseases of the teeth, with special reference to food, diet, hygiene, and other such factors, summarizes a large amount of data, and contains a full report of the conference on oral hygiene held at Manchester, England, in 1920. Some of the papers presented at this conference, which report experimental work, are Cause and Prevention of Dental Caries, by J. S. Wallace; Prevention of Dental Caries, by J. Wheatley; Effect of Certain Dietetic Factors on the Development of Teeth and Jaws, by M. Mellanby; and Influence of Dental Disease in Pregnant and Nursing Women, by H. Waller.

The Pirquet system of nutrition and its applicability to American conditions, W. E. CARTER (*Jour. Amer. Med. Assoc.*, 77 (1921), No. 20, pp. 1541-1546).—This is a discussion of the applicability of the Pirquet nem system (E. S. R., 44, p. 559) to American conditions as determined by the examination, according to this system, of 1,282 children in the San Francisco schools.

As judged by this system, the highest degree of malnutrition was found in the schools in the very poor quarter of the city and the next highest in the wealthy district, while the children showing the best nutritional status came from the industrial districts. The tuberculosis children of an open-air school who received a free supplementary meal daily gave a higher average than the children of the regular school to which this open-air school was attached.

The author is of the opinion that the nem system is applicable to conditions in this country.

Pirquet's feeding system, E. C. VAN LEERSUM (*Nederland. Tijdschr. Geneesk.*, 65 (1921), I, No. 26, pp. 3465-3478).—A summary and critical discussion.

Permanent gains from the food conservation movement, H. C. SHERMAN (*Columbia Univ. Quart.*, 21 (1919), No. 1, pp. 1-14).—The author discusses the nutritional significance of the substitutions involved in the food conservation campaign of the Food Administration during the recent war and makes an urgent plea for the continuance of the food habits formed at this time, "both because the world situation demands careful use of food resources for a long time to come and because the changes in food habits which the food-saving campaign has sought to teach are directly beneficial to the American consumer individually and to the economic development of American agriculture."

Permanent gains from the food conservation movement, H. C. SHERMAN (*Cornell Reading Course for the Home*, No. 139 (1921), pp. 12).—Essentially noted above.

A report of the director of institution economics, C. M. FEENEY (*Oxford, Ohio: Miami Univ.*, 1920, pp. 79).—This bulletin presents information regarding the methods employed in handling the problems of boarding and housekeeping departments in Miami University, and also the results of some special studies carried on, the basis of comparison being derived from records of the total food used for 385 persons. It was calculated that the diet for February, 1916, supplied 90 gm. of protein and a fuel value of 3,300 calories per person per day, phosphoric acid being 3 gm., calcium 1.06 gm., and iron 0.015 gm.

Similar information is summarized regarding the cost of food in other boarding halls. In the three boarding halls the total calories ranged from 2,842 to 3,204 per person per day, of which protein contributed from 12.5 to 13.6 per cent.

A weekly menu rotation having proved unsatisfactory, a study was made of a three weeks' menu series (which is given in detail) and which was more of a success. However, the meal combinations were remembered and it was soon found that the series was not long enough for regular repetition. Accordingly a series of menus for six weeks was adopted, which has given more nearly the desired results.

Standardized hundred-portion recipes collected by the boarding department are given in the report. These include calculated total fuel value and the proportion contributed by protein.

Size and weight in 136 boarding school boys (Groton), H. GRAY and W. J. JACOMB (*Amer. Jour. Diseases Children*, 22 (1921), No. 3, pp. 259-271, figs. 5).—This paper compares certain of the current standards for estimating the normality of boys from comparisons of height, chest girth, weight, and age with actual observations on 136 healthy private school boys. In addition to the customary standards, ideal standards for boys of this type as prepared from a study of 380 private country school boys (this number including the 136 of the present study) are proposed and included in the comparison. The observations and comparisons reported are thought to indicate that the ideal standards as presented are of greater value than the current standards for judging the size and weight of children of boarding and country day schools.

Ideal tables for size and weight of private school boys, H. GRAY (*Amer. Jour. Diseases Children*, 22 (1921), No. 3, pp. 272-283).—This paper discusses in greater detail the ideal standards given in the previous paper. Both papers should be consulted in the original for the data as presented.

A preliminary inquiry into the diet of Australians, H. S. H. WARDELAU (*Sydney: N. S. Wales Bd. Trade*, 1921, pp. 11).—This publication gives the results of determinations of the composition and energy value of the diet of 9 Australians, 5 men and 4 women, who were engaged in laboratory work at the time. The material for the analyses consisted of duplicates of the food consumed by each subject for a single period of 24 hours. In three cases data were obtained on 2 or 3 consecutive days. Experiments were carried out during the months of October, November, and December.

The average daily energy value of the diet of the 5 women subjects was 1,977 calories and of the 4 men subjects 2,110 calories. The average daily weights of the constituents of the diets of the women subjects were fat 70.2, carbohydrate 264.2, protein 58.9, and ash 12.1 gm., and of the men subjects fat 66.5, carbohydrate 293, protein 71.2, and ash 13.5 gm. Calculated as percentages, these values became for the women subjects fat 17.3, carbohydrate 65.1, protein 14.5, and ash 3 per cent, and for the men subjects fat 15, carbohydrate 66.1, protein 16.1, and ash 3 per cent. The average calories per square meter of body surface were 1,260 for the women and 1,207 for the men. Corresponding figures per kilogram of body weight were 37.4 and 33.2, respectively.

It is of interest that these figures show a greater energy consumption per unit of weight and per unit of body surface for the women than for the men subjects, and that the average energy consumption of the women subjects amounts to 95 per cent of that of the men instead of the generally assumed value of 83 per cent. The fact that both the average energy values and the protein contents of these diets are distinctly lower than those of standard diets for persons of similar degrees of activity in cold climates indicates that lower standards of energy value are probably necessary in warm than in cold climates.

The physiology and psychology of taste, H. HENNING (*Ergeb. Physiol.*, 19 (1921), pp. 1-78, fig. 1).—This is an extensive review of the literature on the subject since 1903. A list of 823 literature references is included.

The physiology of protein metabolism, E. P. CATHCART (*London and New York: Longmans, Green & Co.*, 1921, new ed., rev. and enl., pp. VIII+176).—The material of the first edition (E. S. R., 28, p. 167) has been thoroughly revised, and a final chapter summarizing the influence of the nonnitrogenous foodstuffs on the metabolism of protein has been added.

Studies in nutrition, VI—VIII (*Amer. Jour. Physiol.*, 56 (1921), Nos. 1, pp. 205–212, figs. 5; 3, pp. 404–407, figs. 2).—Continuing the studies in nutrition previously noted (*E. S. R.*, 45, p. 664), three papers are presented.

VI. *The nutritive value of the proteins of the Lima bean, Phaseolus lunatus*, A. J. Finks and C. O. Johns (pp. 205–207).—A ration of raw or cooked Lima bean meal 75, salt mixture 4, butter fat 10, and lard 11 per cent maintained the weight of experimental rats, but growth did not occur. On the substitution of 0.3 per cent of cystin for the same amount of bean meal, growth occurred on the cooked meal ration but not on the raw. These results are thought to point to a sufficiency of vitamin B and a deficiency of lysin in the Lima bean.

VII. *The nutritive value of the proteins of the adsuki bean, P. angularis*, C. O. Johns and A. J. Finks (pp. 208–212).—A similar study of the adsuki bean (*P. angularis*), is reported. Raw or cooked adsuki bean meal supplemented with cystin furnished adequate protein and vitamin B for normal growth, while similar diets without the addition of cystin enabled the rats to grow at only from one-third to two-thirds of the normal rate. Comparable results were obtained with the globulin of the adsuki bean.

VIII. *The nutritive value of the proteins of tomato seed press cake*, A. J. Finks and C. O. Johns (pp. 404–407).—A diet consisting of tomato seed press cake 50, commercial cornstarch 21, lard 15, butter fat 10, and Osborne and Mendel's salt mixture 4 parts brought about normal growth in young albino rats, showing that the press cake contained sufficient water-soluble vitamin, as well as satisfactory protein. On substitution of the butter by lard adequate growth was also secured, thus indicating a sufficiency of fat-soluble vitamin in either the press cake or residual oil.

Demonstration of food proteins in human breast milk by anaphylactic experiments on guinea pigs, W. R. SHANNON (*Amer. Jour. Diseases Children*, 22 (1921), No. 3, pp. 223–231).—Several cases of anaphylactic reactions in nursing infants are reported, with recovery on the omission of eggs from the mother's diet. This fact, together with the demonstration of anaphylactic reactions in guinea pigs sensitized to egg protein and subsequently injected with the breast milk under investigation, is thought to demonstrate that egg protein may be present in breast milk after the ingestion of moderate quantities of eggs by at least some nursing mothers, and that the presence of the protein may cause an anaphylactic reaction in the child.

Creatinin and creatin in muscle extracts, I, II, F. S. HAMMETT (*Jour. Biol. Chem.*, 48 (1921), No. 1, pp. 127–141).—Two papers are presented.

I. *A comparison of the picric acid and the tungstic acid methods of deproteinization* (pp. 127–131).—Attention is called to various criticisms of the Folin method for the deproteinization of blood, milk, and tissues by means of picric acid in creatin and creatinin determinations, and a comparison is reported of this method and the method of deproteinization with sodium tungstate and 2N/3 sulphuric acid, the materials used being extracts in Tyrode's solution of freshly prepared tissues of albino rats killed with ether. The results obtained in parallel determinations were concordant.

II. *The influence of the reaction of the medium on the creatinin-creatin balance in incubated extracts of muscle tissue of the albino rat* (pp. 133–141).—This paper reports the results of determinations of the creatinin and creatin content of extracts of muscle tissues of albino rats prepared as described in the above paper when incubated at body temperature for 24 hours in Tyrode's solution alone or buffered to neutrality or alkalinity.

In all cases an increase in the creatinin content of the muscles took place, varying in extent with the reaction of the medium. In unbuffered solutions

this increase was 100 per cent, in solutions buffered to neutrality by phosphate mixture 175 per cent, and in solutions buffered to slight alkalinity 124 per cent. Since no change took place in the total creatinin of the extracts, it is assumed that the creatinin is formed from the creatin of the muscle tissue and that probably the same change takes place in living tissue. The increased creatin excretion in experimental acidosis and alkalosis is thought to be due to retardation of creatinin formation under these conditions.

Nutrition and growth on diets devoid of true fats, J. C. DRUMMOND and K. H. COWARD (*Lancet [London]*, 1921, II, No. 14, pp. 698-700, fig. 1).—The problem of the dispensability of fat in the diet (E. S. R., 44, p. 666) has been further tested by a comparison of the growth curves of young male and female rats on diets similar in make-up with the exception that one furnished 15 gm. daily of purified fat and the other no fat but a corresponding increase in starch. The fat-soluble vitamin was furnished in the form of from 0.2 to 0.4 gm. of the unsaponifiable matter from fish oil. The protein (caseinogen) and starch of the diet were rendered as free from fat as possible by repeated extraction with hot alcohol and ether. The only possible source of fat was considered to be the yeast, the ether extract of which was, however, found to be almost negligible.

The rats on both rations grew normally, although more deaths were encountered among the animals on the fat-free diets than on those receiving fats. A note appended to the paper states that several healthy normal litters of young have been reared by the females on the fat-free diet as well as by those on the diet containing fat. "It would appear that neutral fats are, from a purely physiological standpoint, dispensable constituents of a diet, provided the other foodstuffs supply a sufficiency of the vitamin frequently found in association with natural fats. The real value of fats as convenient sources of energy is obvious."

Observations on the effects of fat excess on the growth and metamorphosis of tadpoles, R. McCARRISON (*Roy. Soc. [London]*, *Proc.*, Ser. B, 92 (1921), No. B647, pp. 295-303, figs. 4).—This is a preliminary report of observations of the effect of excess fat with or without iodine on the metamorphosis and growth of tadpoles, the investigation being conducted for the purpose of obtaining some explanation of the harmful effects sometimes noticed as the result of the presence of excessive amounts of fat in the food of animals.

On a basal ration of flour 85 and caseinogen 15 parts, with fresh pondweed ad libitum, and with various additions of fats either alone or with iodine, the following results were obtained: An excess of the various fats used caused great retardation in the rate of growth of the tadpoles. Iodine in amounts of 0.5 to 1 mg. tended to compensate for the retardation of growth induced by butter, lard, oleic acid, coconut oil, and peanut oil, but not for that induced by linseed oil and cod liver oil. The normal rate of metamorphosis was delayed by the fluid and less saturated fats, but not noticeably affected by the harder fats. Iodine tended to compensate for the retardation of metamorphosis in the case of oleic acid and peanut oil, but not in the case of linseed oil and cod liver oil. A high iodine intake caused abnormal metamorphosis, which was considerably hastened by a high proportion of butter in the food mixture and to a lesser degree by coconut oil, but was markedly retarded by similar amounts of cod liver oil.

The author concludes that with certain fats an iodine intake proportional to the intake of the fats is requisite for the maintenance of normal metabolism.

The physiological value of hydrogenated oils (*Chem. Age [London]*, 5 (1921), No. 125, pp. 550-552).—The author discusses the effect of hydrogenation upon the vitamin content of edible hydrogenated oils, and suggests the possi-

bility of employing palladium as a catalyst in place of nickel, as palladium requires a much lower temperature than nickel.

Dietary factors influencing calcium assimilation.—I, The comparative influence of green and dried plant tissue, cabbage, orange juice, and cod liver oil on calcium assimilation, E. B. HART, H. STEENBOCK, and C. A. HOPPERT (*Jour. Biol. Chem.*, 48 (1921), No. 1, pp. 33-50).—Supplementing the preliminary report previously noted (E. S. R., 44, p. 64), further data on the influence of dietary factors on calcium assimilation by the dry and lactating goat are presented.

Five goats were used during the course of the experiment, three lactating and two dry. The animals were confined in metabolism cages with quantitative collection of the excreta, and the lactating animals were milked twice daily. Calcium determinations were made on the weekly collection of feces and the weekly composites of aliquots of urine and milk taken daily. The McCrudden method, after ashing, was used for feeds, milk, and feces, and the same without ashing for the urine. The animals were fed a grain mixture consisting of 30 parts of yellow corn, 15 of oil meal, 30 of whole oats, 24 of wheat bran, and 1 of common salt. The roughages were varied in successive periods and consisted of alfalfa hay, oat straw, green oats, and dried green oats.

On the basal ration and on this ration plus oat straw a negative calcium balance was established, both in the lactating and nonlactating animals. The substitution of green oats for the oat straw led to a decrease in the loss of calcium, although not to a positive balance. Oat hay prepared by drying fresh oats in diffused light in an attic gave results comparable to the green oats, and in one animal even a positive calcium balance.

To determine the possible factors in the green materials operative in facilitating calcium retention, the basal ration was supplemented successively with butter fat, orange juice, dried cabbage, fresh cabbage, and cod liver oil in the case of one lactating and two nonlactating animals. Orange juice (120 to 240 cc. per day) and raw cabbage (1,000 gm. per day) or dried cabbage had no influence on the calcium assimilation. Cod liver oil (5 to 10 cc. per day) consistently changed negative calcium balances to positive. These data are thought to eliminate vitamin C as a factor in calcium assimilation, and to show that the same factor affecting calcium assimilation is present in green oats and grasses and in cod liver oil.

The distribution of zinc in the fish, M. BODANSKY (*Compt. Rend. Acad. Sci. [Paris]*, 173 (1921), No. 18, pp. 790-792).—Studies of the distribution of zinc in marine animals, previously noted (E. S. R., 46, p. 260), have been supplemented by analyses by the method recently described (E. S. R., 46, p. 111) of the catfish (*Ailurichtys marinus*) and the red snapper (*Lutjanus aya*). In the latter the milt and the liver appeared to contain the largest proportion of zinc, 43.5 and 55.5 mg. per kilogram, respectively. The skin, bones, etc., contained a larger proportion of zinc than the muscles, the content of the latter being about 2.3 mg. per kilogram. In the catfish the liver contained a fairly large proportion of zinc, but the greatest amount was in the gills which averaged 102.5 mg. per kilogram.

Feeding experiments with mixtures of foodstuffs in unusual proportions, T. B. OSBORNE and L. B. MENDEL (*Natl. Acad. Sci. Proc.*, 7 (1921), No. 6, pp. 157-162, figs. 3).—Essentially noted from another source (E. S. R., 45, p. 764).

The nutritive properties of milk, with special reference to growth and reproduction in the white mouse, H. A. MATTILL (*Soc. Expt. Biol. and Med. Proc.*, 18 (1921), No. 7, pp. 242, 243).—The author reports briefly that white mice are similar to rats in their inability to reproduce on an exclusive ration of

dried milk, but that reproduction to the fourth generation has been secured on a food mixture of dried whole milk 93, salt mixture 2, and yeast 5 per cent. "What constituent of yeast is responsible for the successful reproduction secured by its addition remains to be determined by the work at present under way."

Vitamin-A content of oils prepared from livers of the cod, coalfish, and haddock. S. S. ZILVA and J. C. DRUMMOND (*Lancet [London]*, 1921, II, No. 15, pp. 753, 754).—A brief report is given of determinations of the vitamin-A content of crude cod, coalfish, and haddock liver oils as freshly prepared at the Norwegian fishing grounds on the Finmarken Coast. As tested by the method used by Zilva and Miura in a previous study of crude cod liver oil (*E. S. R.* 45, p. 564), the minimum daily requirements of the various oils for the resumption of growth in rats was 2 mg. for cod-liver oil, slightly less for coalfish oil, and from 10 to 15 mg. for haddock oil. It is noted that the so-called cod liver oil from Finmarken is generally a mixture of oils from the three varieties of fish examined, and may sometimes contain no cod liver oil at all.

The presence of vitamin A in the peel of common citrus fruits. E. COOPER (*Soc. Expt. Biol. and Med. Proc.*, 18 (1921), No. 7, pp. 343, 344).—Dried orange peel slightly grated and extracted on the water bath with ether and alcohol yielded on evaporation to dryness a gummy mass which proved to be rich in vitamin A. It is stated that experiments now in progress indicate that similar preparations made from lemon and grapefruit peel also contain vitamin A.

The effect on the guinea pig of deprivation of vitamin A and the anti-scorbutic factor, with special reference to the condition of the costochondral junctions of the ribs. F. M. TOZER (*Jour. Path. and Bact.*, 24 (1921), No. 3, pp. 306-325, pls. 2, figs. 7).—The results are reported of a study of the histological condition of the bone tissue of guinea pigs suffering from deprivation of vitamin C, of vitamin A, or of both these vitamins. The animals serving as controls received oats and bran ad libitum, 10 cc. daily of orange juice as the source of vitamin C, and autoclaved milk ad libitum (averaging about 70 cc.) as the source of vitamin A, while the other groups received this ration with the omission of the orange juice, milk, and both orange juice and milk, respectively.

The results obtained are given in a table in which a comparison is made of the symptoms during life, weight, appearance at autopsy, and histology of the rib junctions of the guinea pigs on the four diets described above. The results as thus tabulated show that unless the scurvy animal is protected from the effects of an insufficiency of vitamin A the results will be complicated and difficult of diagnosis. Conditions characteristic of scurvy alone are considered to be loose teeth, tender and swollen joints, and the occurrence of hemorrhage, particularly in the limbs. In scurvy complicated by lack of vitamin A death, usually takes place earlier than with scurvy alone. The weight curve shows both the flattening due to lack of vitamin A and the rapid fall which is characteristic of lack of vitamin C. The scurvy symptoms are apt to mask those caused by lack of vitamin A. Atrophy of the bone marrow is thought to follow deprivation of vitamin A and to be of assistance in determining doubtful cases.

None of the animals on diets deficient in vitamin A alone showed the general pathological picture of rickets, but in animals suffering from prolonged deprivation of vitamin A and from scurvy complicated by lack of vitamin A histological appearances at the costochondral junction bearing some resemblance to rickets have been observed.

Effect of undernourishment on mammalian ovary and the sexual cycle. L. LOEB (*Jour. Amer. Med. Assoc.*, 77 (1921), No. 21, pp. 1646-1648).—This is a short summary of investigations which have been conducted in the author's

laboratory during the past 10 years on the effect of undernourishment on various bodily functions.

Hunger-osteomalacia in Vienna, 1920, I, II (*Lancet* [London], 1921, II, No. 17, pp. 842-853, figs. 2).—This study of hunger-osteomalacia as it occurred in Vienna at the close of the World War is reported in two papers as follows:

I. *Its relation to diet*, E. J. Dalyell and H. Chick (pp. 842-849).—A brief description is given of the history, symptoms, and course of hunger-osteomalacia as studied in Vienna from January to May, 1920. The symptoms on which the diagnosis was based are described as "pain on body movement, a waddling gait, difficulty in mounting stairs, severe pain in sacral region on pressure or movement, and pain in the ribs on compression of the thorax. Tetany may occur in association with the disease."

The diets of the patients examined had consisted mainly of bread and vegetables, with small amounts of flour and sugar and a small and irregular amount of lard. The dietetic treatment included additions to this diet of (1) sugar and cereals, (2) vegetable oils (margarin, olive oil, etc.), (3) butter and eggs, (4) cod liver oil, (5) vegetable oil containing phosphorus, and (6) green vegetables, respectively. So far as possible these additions were roughly equivalent in calorie value.

Little improvement resulted from the addition to the diet of sugar or cereals, i. e., from increasing the energy value of the diet, but recovery followed the addition of cod liver oil, butter, oleomargarin containing 80 per cent of animal fat, or olive oil in decreasing order. Some of the more severe cases did not improve until cod liver oil was given and that in relatively large amounts. It is regarded as significant that the relative therapeutic value of the fats used corresponds roughly with their content in vitamin A, and also that the greatest incidence of the disease was in winter when fresh vegetables were absent from the diet. One attempt, however, to cure a severe case with a fat-free diet rich in green vegetables was unsuccessful.

A possible connection between rickets, late rickets, and hunger-osteomalacia is noted.

II. *Comparative treatment of cases of hunger-osteomalacia in Vienna, 1920, as out-patients with cod liver oil and plant oil*, E. M. Hume and E. Nirenstein (pp. 849-853).—This is a detailed report of a comparative study of the therapeutic value in hunger-osteomalacia of a phosphorus-containing plant oil, subsequently identified as belonging to the rape oil group, and of cod liver oil.

Of the 130 patients comprising the group studied, about one-third were treated with the plant oil and two-thirds with the cod liver oil, daily doses of 100, 150, and 200 cc. of the oil being given. The cod liver oil proved superior to the plant oil, although definite improvement occurred in a few cases with the larger amounts of the plant oil. While in some cases the doses of cod liver oil had to be increased before definite improvement resulted, the rate of progress did not appear to be very different with the different amounts of oil after improvement had once set in. The authors conclude provisionally that the cure of the disease was due to the addition of vitamin A rather than of fat as fat to the diet. It is reported in an appendix that the tests of the phosphorus oil by J. C. Drummond showed it to be almost if not wholly incapable of restoring growth in rats which had declined on a diet deficient in vitamin A in the quantities which could be consumed by rats, but that such quantities are necessarily small.

Experimental rickets in rats, V. KORENCHEVSKY (*Brit. Med. Jour.*, No. 3171 (1921), pp. 547-550).—This is a preliminary communication of the results of an extensive study of experimental rickets in rats. The basal diet consisted of

purified casein 18, starch 52, fat 15, and marmite 5 gm., orange juice 5 cc., and distilled water 50 cc. When a diet deficient in vitamin A was desired the fat consisted of cottonseed oil, while if it was to be rich in vitamin A a mixture of 12.5 gm. of butter fat and 2.5 gm. of cod liver oil was used. Variations in calcium were effected in the salt mixtures, 5 gm. of which was added to the basal diet. From 10 to 20 gm. of the food mixture was supplied daily to each animal according to age.

The diet deficient in calcium alone produced changes in the skeleton of the rats resembling but not identical with rickets. These changes were more marked when the diet of the mother during lactation had also been deficient in calcium.

Deficiency in vitamin A caused changes similar to and in some cases typical of rickets, the latter only when the parents had the diet deficient in A during conception, pregnancy, and lactation.

Changes typical of rickets occurred most frequently on diets deficient in both calcium and vitamin A. The author is of the opinion that "vitamin A is apparently closely related to the metabolism of calcium in the organism and particularly in the bone. . . . Its action may not inappropriately be compared with that of an amboceptor provided the analogy is not pressed too far."

The preparation of tikitiki extract for the treatment of beriberi, A. H. WELLS (*Philippine Jour. Sci.*, 19 (1921), No. 1, pp. 67-73).—The author describes methods now in use for the manufacture of tikitiki extract (extract of rice polishings) for the treatment of beriberi in the Philippines. The extract, which is bottled in 50-cc. bottles, contains in 1 cc. the native constituents of 20 gm. of rice polishings. During 1920 the Philippine Bureau of Science manufactured 10,870 bottles of this extract, an amount far below the actual requirements. It is estimated that a campaign for the treatment of beriberi throughout the Philippine Islands would require a plant with a capacity for the production of 15,000 bottles of the extract monthly.

Alcoholic extracts of brewers' yeast in avian polyncuritis, H. PENAU and H. SIMONNET (*Compt. Rend. Soc. Biol. [Paris]*, 85 (1921), No. 24, pp. 198-200).—This is a brief summary of the results of determinations of the minimal protective doses of alcoholic extracts of dried yeast for pigeons on the basal vitamin-free ration previously described (E. S. R., 45, p. 166). One sample of yeast was subjected to three successive extractions for 20 hours each with alcohol at from 80 to 85° C., and another sample to seven extractions of 48 hours each with alcohol at from 15 to 20°.

While the extracts prepared at the higher temperatures proved slightly superior to the cold, the difference was not marked. Daily doses of 0.1 gm. of the dried extract proved sufficient to keep the experimental pigeons in good health. The protection conferred by the extract did not continue for more than 5 to 10 days after the extract had been omitted from the diet, no matter how long the experiment had been continuing, thus showing no appreciable storage of vitamin B in the body.

The weight curves showed that for a food intake of from 70 to 100 gm. the amount of extract required for a 300-gm. pigeon varied from 0.07 to 0.1 gm., while for a 500-gm. pigeon the amount had to be increased to 0.15 gm. Variations in the weight curves followed those of the extract administered with a lag of from 3 to 5 days.

The fractional extraction yielded products of decreasing activity, but some activity remained even to the seventh extraction. The yeast remaining also showed some activity. No loss in activity resulted from preservation of the alcoholic extracts in closed flasks in a desiccator for a period of at least six months.

Artificial ration for pigeons.—Effects of deficiency of brewery yeast, H. SIMONNET (*Bul. Soc. Sci. Hyg. Aliment.*, 9 (1921), No. 2, pp. 69–85, pl. 1, figs. 4).—This paper supplements the above paper and one previously noted (*E. S. R.*, 45, p. 166) by a full description, illustrated by weight and temperature curves, of polyneuritis in pigeons induced by the artificial ration previously described. This ration, supplemented by a small amount of dried brewery yeast (0.5 to 1 gm.), when administered by forced feeding in amounts of from 20 to 50 gm., daily served to keep a young experimental pigeon for from 2 to 3 months in approximate weight equilibrium, slight changes in weight following quite promptly changes in the amount of food administered, while the same diet minus the yeast induced symptoms of polyneuritis in from 19 to 49 days. During the period before the symptoms of polyneuritis appeared the weight curves showed only slight fluctuations resulting from variations in the amount of food ingested. In no case was there the significant loss in weight which is the rule on a polished rice diet. Contrary to the results of McCarrison, the author reports that autopsy revealed no macroscopic lesions indicating a marked interference with the mechanism of digestion. This is attributed to differences in the experimental ration.

“The fact that with our régime the animals eat until the last day, that it is possible to cure in a permanent manner very severe nerve lesions, and to obtain in series symptoms followed by cure, inclines us to think that the intestinal lesions noted by the English investigator (McCarrison) refer to another cause and that the nerve manifestations are purely functional.”

These results are thought to show the possibility of dissociating the factor of inanition to a very great extent, and of thus simplifying the study of the question of the identity or nonidentity of the growth-promoting water-soluble B and the antineuritic factor. Attention is called, however, to differences in the pathogenesis of deficiency disease in different species of experimental animals. With the pigeon under suitable conditions the nerve lesions appear before evidences of inanition, in the rat the nerve lesions are less marked than the effects of inanition, and in the dog, as shown by Karr (*E. S. R.*, 44, p. 860), the nerve lesions manifest themselves only in those animals which continue to eat until nearly the time of appearance of the nerve symptoms, while others which refuse to eat die of inanition before the appearance of nerve lesions.

Vegetable problems in diabetic diets, W. A. ORTON (*Amer. Jour. Med. Sci.*, 162 (1921), No. 4, pp. 498–509).—A list of vegetables with low carbohydrate content, many of them not common but particularly worth while to introduce variety in such special diets and which can be grown in the garden, is suggested; and the importance of greens and salads in diabetic diets on account of the high content of salt and vitamins and as a help in constipation is pointed out.

On the basis of experience in preparing vegetables in palatable form, the author discusses blends and mixtures of vegetables, and makes suggestions regarding the use of vegetable mixtures, vegetable cookery, and hearty vegetable soups. A method of computing the food value of such a soup is described.

Canned dinners and lunches made up of vegetables for use when traveling, or away from home for other reasons, are recommended and discussed as helpful to one who is following a strict diet. The cooking of different vegetables is considered in considerable detail, special attention being paid to “thrice cooked” vegetables. The use of a pressure cooker under suitable conditions is also mentioned.

The recipes and suggestions are based on the author’s experience, and much information is summarized regarding varieties of vegetables. Some unusual

and special qualities are pointed out, for instance the use of roasted soy beans, which the author considers as good as "roasted peanuts" and much safer for the diabetic. They are prepared by first soaking the soy bean over night in salted water, cooking for an hour, spreading out thinly on tins, and roasting in a moderate oven until crisp.

A bacteriological study of the fecal flora of infants and children (the lack of association of nutritional disorders with a so-called "putrefactive" intestinal flora), W. C. DAVISON and L. V. ROSENTHAL (*Amer. Jour. Diseases Children*, 22 (1921), No. 3, pp. 284-298, figs. 2).—The authors report a study by the methods of Morris, Porter, and Meyer, slightly modified (*E. S. R.*, 42, p. 260), of the bacterial flora of 126 stools from 75 infants fed as follows: Fourteen infants with intestinal disturbances were fed on protein milk, buttermilk, or soft diet. Of the others, all of whom were in normal health, 14 were fed on human milk alone, 11 on human milk with supplementary feeding of modified cow's milk, and 36 on modified cow's milk and soft diet.

The results obtained did not confirm the conclusions of Porter et al. that a putrefactive flora is of diagnostic importance in certain intestinal disorders, nor that diet has a pronounced influence on the incidence of putrefactive flora. Although the highest percentage of putrefactive stools was obtained from patients with intestinal disturbances many such children had a normal flora, while a comparatively large number of the stools from normal children were putrefactive.

Food infections, with an illustrative outbreak, M. J. ROSENAU and H. WEISS (*Jour. Amer. Med. Assoc.*, 77 (1921), No. 25, pp. 1948-1951, figs. 3).—Following a brief discussion of the symptoms and cause of most outbreaks of food poisoning or food infection, a description is given of a typical outbreak occurring in Washington, D. C., among a number of medical students. The outbreak was definitely traced to bread pudding from which was isolated *Bacillus enteritidis*.

Botulism problem in the United States, R. E. DOOLITTLE (*Canner*, 53 (1921), No. 25, pp. 29, 30; also in *Amer. Food Jour.*, 16 (1921), No. 11, pp. 14, 15).—This is a brief discussion of the responsibility which lies with the manufacturers, distributors, and inspection officials of food products in regard to the prevention of botulinus poisoning. It is emphasized that in most cases the products contaminated with *Bacillus botulinus* have not been found in a few spoiled packages among a great number of sound packages, but rather as an occasional sample among many spoiled packages from the same lot of goods. Consequently any consignment containing a large number of spoiled cans should be regarded as suspicious, and the goods appearing sound should be reprocessed before distribution.

The physiological cost of muscular work measured by the exhalation of carbon dioxid, A. D. WALLER and G. DE DECKER (*Brit. Med. Jour.*, No. 3149 (1921), pp. 669-671, figs. 4).—Using the methods employed in their previous studies (*E. S. R.*, 45, p. 670), the authors have determined the energy output (1) of colliers during their work at the coal face and (2) of shoemakers during work in the finishing room of a shoe factory. Estimation of carbon dioxid output for 30 seconds every hour throughout the day's work were made on two men on three successive days. The average net calories per hour per square meter of body surface was 96 for colliers and 32 for shoemakers.

This paper also includes a table in which are summarized the results of the previously reported and present observations on the physiological cost of different kinds of muscular work. A grading of work in terms of cubic centimeters of CO₂ exhaled per second (gross) and of the approximate caloric expenditure is

given as follows: Sedentary work below 5 cc. of CO₂ and below 100 calories; light work from 5 to 10 and from 100 to 200; medium work from 10 to 15 and from 200 to 300; and heavy work from 15 to 20 and from 300 to 400, respectively.

The physiological cost of muscular work, L. HILL and J. A. C. CAMPBELL (*Brit. Med. Jour.*, No. 3151 (1921), pp. 733, 734).—The authors suggest that in the work reported above by Waller and De Decker the short duration of the experiment introduced the possibility of considerable error. Another factor on which it is thought that sufficient emphasis has not been placed is the influence of food on the carbon dioxid output. Data given in illustration of this last point show a considerable increase in carbon dioxid following the ingestion of food.

The physiological cost of muscular work: A reply to objections, A. D. WALLER and G. DE DECKER (*Brit. Med. Jour.*, No. 3173 (1921), pp. 627-630, fig. 1).—This is a detailed reply to the above paper.

ANIMAL PRODUCTION.

Investigations of the feeding value of straw hydrolyzed by various processes.—I, Hydrolysis of straw with hydrochloric acid, F. HONCAMP and E. BLANCK (*Landw. Vers. Sta.*, 93 (1919), No. 3-4, pp. 175-194).—The authors report the results of two series of digestion experiments with sheep fed straw hydrolyzed with hydrochloric acid according to two processes. In the so-called Minck process the chopped straw is fed into a Minck mill, heated, moistened with hydrochloric acid, heated again, and neutralized with soda. This process markedly decreased the digestibility of all the organic nutrients.

By the second method of treatment, attributed to C. G. Schwalbe, the chopped straw is heated with steam in a revolving drum, sprayed with hydrochloric acid, and then neutralized with chalk and soda. This process increased the digestibility to a slight extent.

Commercial feeding stuffs, J. D. TURNER, H. D. SPEARS, and E. L. JACKSON (*Kentucky Sta. Bul.* 235 (1921), pp. 165-301).—This bulletin, dealing with the inspection and analysis of feeding stuffs principally for the year 1920, discusses a number of illegal practices entering into the manufacture and sale of commercial feeds, and presents in tabular form the results of the examination of individual samples.

Commercial feeding stuffs, 1920-21, J. M. BARTLETT (*Maine Sta. Off. Insp.*, 100 (1921), pp. 21-60).—A brief discussion of the feeds examined, definitions of feeding stuffs, and a list of all compound feeds registered with the composition claimed for them are given, and the analyses and guaranties of all feeds collected are presented.

Feeding stuffs inspection, J. L. HILLS, C. H. JONES, ET AL. (*Vermont Sta. Bul.* 223 (1921), pp. 12-19).—The results of the chemical examination of samples of feeding stuffs for protein only are reported, and the guaranties of the protein content of the different commercial feeds, together with the deficiencies occurring, are given.

Sex-specific influence of gonad extracts, A. WEIL (*Pflüger's Arch. Physiol.*, 185 (1920), pp. 33-41, figs. 8).—This is a study of the gaseous metabolism of guinea pigs as influenced by subcutaneous injection of the extracts of the gonads of cattle. In the case of young males, castrated males, and pregnant females, the testicular extracts produced a sudden fall in the CO₂ output followed by a more rapid rise to above normal. Ovarian extracts produced a similar but less marked change, which was also observed in adult females.

Neither extract influenced the CO₂ curve of adult males. Sex-specific nervous symptoms were also provoked by the injections.

Does evolution occur exclusively by loss of genetic factors? W. E. CASTLE (*Amer. Nat.*, 53 (1919), No. 629, pp. 555-558).—The author considers Duerden unduly pessimistic about the possibility of increasing the number of ostrich plumes by selection, and cites his own success in producing a strain of domestic guinea pigs having a toe (digit V) on the hind foot which wild species of the genus *Cavia* have lost in the course of evolution.

Ostrich study in South Africa, J. E. DUERDEN (*Nature [London]*, 105 (1920), No. 2630, pp. 106-108, figs. 3).—A brief summary of some of the facts as to plume production and the degeneration of the wings, feathers, and toes of ostriches.

"To the highly contentious question of the inheritance of acquired characters, the ostrich would appear to have a contribution to offer. Owing to the loss of its second toe, the crouching bird, for mechanical reasons, no longer makes use of the symmetrical axial callosity at the ankle, but develops an accessory one to the side. This is formed anew with each generation, and must have done so ever since the second toe disappeared, though presumably this happened thousands and thousands of generations ago. No hint of the accessory callosity occurs on the newly hatched chick; it is not inherited, but has to be acquired anew each time. On the other hand, the hereditary axial callosity, though unused for the same period, shows no signs of reduction; it has persisted through the ages, though nonfunctional. Further, the ostrich rests upon its sternal and pubic projections, and a strong callosity is developed over each. These would unquestionably form as a direct response of the skin to the pressure and friction involved in crouching, but are found to be hereditary, showing on the newly hatched chick."

A stalked parapineal vesicle in the ostrich, J. E. DUERDEN (*Nature [London]*, 105 (1920), No. 2643, pp. 516, 517, figs. 2).—The author has investigated the embryonic development of the pineal gland in the ostrich and concludes that the area of featherless skin toward the hind part of the head in the adult represents the persistent integumental covering of the ancestral pineal eye.

Notes on farm animals and animal industries in China, C. O. LEVINE (*Canton Christian Col. Bul.* 23 (1919), pp. 54, pls. 4).—This is an account of some of the characteristic features of Chinese live stock industries, based mainly on the author's observations in southern China and supplemented by the published reports of the Japanese authorities on the cattle, egg, wool, and live stock industries of Shantung. Particular attention is given to poultry raising, swine raising, dairying, and the use of the water buffalo as a dairy animal. The sections on swine, sheep, and goats have been noted from another source (*E. S. R.*, 43, p. 171), while those on dairying and the water buffalo are noted as a separate paper (*E. S. R.*, 42, p. 771; and on p. 577).

Native horses and cattle in the Orient, C. O. LEVINE (*Jour. Heredity*, 11 (1920), No. 4, pp. 147-155, pl. 1, figs. 4).—The sections on the horses and cattle of China, the future of the live stock industry in China, and the need for trained live stock men and veterinarians in the monograph noted above are here presented with slight changes and with added illustrations.

On the indices of the horse, ROUAUD (*Rev. Vét. [Toulouse]*, 72 (1920), No. 9, pp. 539-548).—This article deals with two indices and their use in grading cavalry and artillery horses, (1) the ratio of the weight in kilograms to the height in centimeters, called the index of compactness, and (2) the ratio of the circumference of the cannon bone to the girth of chest, called the dactylorhacic index. The author recognizes the congruity of using the cube of the

height in measuring compactness, but thinks that the index as defined is a satisfactory compromise because it is already known to sportsmen. The French Remount Service has been in the habit of using the ratio of weight to the height in excess of 1 meter, considering this more "mathematical."

[**Poultry work at the New Jersey Stations**], H. R. LEWIS and I. L. OWEN (*New Jersey Stas. Rpt. 1920*, pp. 112-119, 133-137, 212-217, 219-223, figs. 2).—The progress made on different projects during the year ended June 30, 1920, is briefly reviewed, and some of the results obtained are reported. Notes are given on the advantages of green crops in poultry yards and of colony breeding.

Experiments on turning the eggs in incubators as related to the percentage of hatch of fertile eggs showed that eggs turned twice daily from the first to the nineteenth day gave a hatch of 73.1 per cent, while those turned two, three, and five times daily from the third to the nineteenth day gave hatches ranging from 61.6 to 62.1 per cent. Turning twice daily from the third to the sixth and from the third to the twelfth day resulted in hatches of only 32.5 and 52.3 per cent, respectively.

From a large number of measurements of the air cell in eggs at different periods of the hatch taken during two years from the best hatches at the experiment station it was found that at the eighth day of incubation the depth of the air cell was $\frac{3}{8}$ in., at the fourteenth day it ranged from $\frac{3}{8}$ to $\frac{2}{3}$ in., and at the nineteenth from $\frac{3}{8}$ to $\frac{3}{4}$ in. The method of making measurements is described and illustrated.

Suggestions based on the results of experiments are given as to the management of the flock and the use of lights in influencing egg production by means of artificial illumination. The results of such experiments with 14 flocks, numbering from 3,371 to 3,940 birds, are given in a table. The monthly price variation in eggs from several different producing regions for a number of years is also shown in a table, and a score card method of judging fowls for egg production developed at a conference held at the Egg Laying Contest at Vineland is presented.

A study of systematic records of one year of the cost of egg production and the amount of profit as furnished by ten cooperators indicated that the deciding factor in profitable egg production is the average production per bird. In the best record about 60 per cent more mash feed than grain was used as compared with only 10 per cent more in the average record. Other influences at work under the conditions producing the best record were abundant alfalfa ranges for young stock and laying flocks, pullets going into the winter in the best of condition, detailed care and attention to layers, especially during the fall and winter, and breeding and selection based on trap nest records and other modern methods.

[**Feeding experiments with laying pullets**, A. G. PHILIPS (*Indiana Sta. Bul. 258 (1921)*, pp. 28, figs. 9).—Experiments were conducted to determine the feeding value of buttermilk and dried buttermilk for White Leghorn pullets and of different amounts of meat scrap for Plymouth Rock pullets. Earlier work at the station has been noted with Leghorns (*E. S. R.*, 41, p. 570) and with Plymouth Rocks (*E. S. R.*, 40, p. 76).

Two experiments of one year each in 1919 and 1920 were made with 30 Single Comb White Leghorn pullets in each of three pens, all receiving a grain ration consisting of 15 lbs. corn, 5 lbs. wheat, and 5 lbs. oats. The mash ration for the pen was made up of 5 lbs. bran and 5 lbs. shorts, but one pen received in addition 50 lbs. buttermilk and one 5.75 lbs. dried buttermilk. The results are presented in tabular and graphic form and are discussed in detail.

Pullets laying 189 eggs each per year consumed 76.6 lbs. and those laying 56 eggs each 59.1 lbs. of feed per year. When given the opportunity, pullets ate

from six to nine times as much oyster shell as grit. The pullets laying heavily consumed each about 90 lbs. of buttermilk per year, and in general the larger the egg production, the greater was the feed consumption. Milk in some form in the ration appeared to increase the efficiency of the other feeds given. The pen on the liquid-buttermilk ration produced 164.7 eggs, that on dried buttermilk 189.4 eggs, and that with no milk 56.6 eggs per pullet per year. The eggs laid by the buttermilk pens were produced at a little less than half the cost of those laid by the no-milk pen. The liquid-buttermilk pen required 3.56 lbs., the dried-buttermilk pen 3.22 lbs., and the no-milk pen 8.61 lbs. of feeds to produce 1 lb. of eggs. In hatching power the eggs from the three pens were similar. The no-milk pen had the heaviest mortality, while in the two buttermilk pens it was about alike. The cost and profit of egg production for the different pens, based on the prevailing prices of feed and eggs, were determined, and the results are presented.

Experiments in feeding different quantities of meat scrap to Plymouth Rock pullets were conducted for three years with five pens of 30 pullets each. The grain ration for all pens consisted of corn 10 lbs., wheat 10 lbs., oats 5 lbs., and the mash ration, excluding the meat scrap, of bran 5 lbs. and shorts 5 lbs. One pen received no meat scrap, the second pen was given 5 per cent of meat scrap in addition to the total ration, or 1.6 lbs., the third pen 10 per cent, the fourth 15 per cent, and the fifth 20 per cent.

Pullets laying well consumed from 90 to 95 lbs. of feed per bird per year, the poor layers consuming from 14 to 19 lbs. less of feed than the better layers. From three to four times as much oyster shell as grit was consumed. The pullets fed no meat scrap averaged 45.8 eggs, those of the 5 per cent pen 107.6, the 10 per cent pen 112.1, the 15 per cent pen 123.1, and the 20 per cent meat-scrap pen 130 eggs per year. It cost less to feed a pullet when no meat scrap was given, but it cost more to produce a dozen eggs.

The no-meat-scrap pen required 13.79 lbs. of feed, the 5 per cent pen 6.88 lbs., the 10 per cent pen 6.71 lbs., the 15 per cent pen 6.25 lbs., and the 20 per cent meat-scrap pen 6.01 lbs. of feed to produce 1 lb. of eggs. The highest egg production, regardless of the ration, occurred in April or May. The pens fed high amounts of meat scrap produced more eggs in the summer months, indicating the necessity of increasing the protein content of the feed in summer and fall. The pullets receiving no meat scrap lost weight during the experiment, while those in the other pens increased in weight. As in the experiments with Leghorns, the cost and profit of egg production are reported.

The egg records of limited periods as criteria for predicting the egg production of the White Leghorn fowl, J. A. HARRIS, W. F. KIRKPATRICK, A. F. BLAKESLEE, D. E. WARNER, and L. E. CARD (*Genetics*, 6 (1921), No. 3, pp. 265-309, figs. 10).—This is an attempt to express the year's egg record as a linear function of the egg production during one or more months. The formulas derived are based upon the records of the White Leghorns entered in the Storrs, Conn., egg-laying contests during the years 1911-1917, and the possibility of using them to predict the egg records of the birds entered in the 1917-18 contest was tested.

"The results show that the annual egg record of a series of birds may be predicted with a reasonably high degree of accuracy when their performance for a single month is known. Somewhat higher accuracy may be obtained when the record of two or more months is taken into consideration, but the improvements due to an increase in the number of months upon which prediction is based is not great."

Hybrids between the peacock and the domestic hen, E. TROUWESART (*Rev. Hist. Nat. Appl.*, 1920, II, No. 4-5, pp. 100-102).—This is a description of two

male hybrids between a peacock of the *nigripennis* variety and a Buff Cochin hen. Both birds were clean legged, bore spurs, and had long wings which permitted them to fly. Their general appearance was that of a peafowl, but they were unable to erect the tail coverts, which, however, were long and arched over the rectrices. The latter were 14 in number, as in the maternal species, and not 18, as in the peafowl. The disagreeable cry of the peacock was absent. The history of the specimens is such as to permit of no doubt as to their hybrid nature, according to the author.

Report of the department of biology, T. C. NELSON (*New Jersey Stat. Rpt. 1920, pp. 319-349, pls. 5, figs. 6*).—The studies here reported related to the larval history of oysters and to the growth and the food of adult oysters. The rate of growth was studied with 150 natural and 850 transplanted oysters. The natural oysters in 133 days increased 21 per cent in weight, 18.9 per cent in length, and 15.3 per cent in width, while the transplanted stock in 122 days increased 31.6 per cent in weight, 18.5 per cent in length, and 21.5 per cent in width.

Examinations of the stomach contents of the oysters showed that the largest quantities of food were found in the stomachs during the flood tide, and that at summer temperatures the stomach may be emptied within an hour after feeding has ceased. Distinct seasonal variations in the food were found correlated with the rise and decline of animal and plant organisms in the water and with the tearing loose and grinding up of the eel grass in the fall. It was found that during the summer months much animal food made up of different marine forms was eaten, and that the stomach contents indicated fairly accurately the organisms present in the plankton. In some individual oysters 80 per cent of the food found was of animal origin. It is stated that rainfall affects the fatness of oysters through the quantities of essential salts brought down from the land, which have a direct effect on the abundance of organisms in the winter. Oysters were found to strain approximately 6 qt. of water per hour of activity, or 120 qt. a day. A study of the food organisms growing on the shells revealed over 56,000,000 diatoms on a single individual.

Observations on the shell movements of oysters on a natural oyster bed indicated an average daily activity of 20 hours. Of all complete closures, 73 per cent occurred during the ebb tide and low water, and of all openings, 63 per cent occurred during the flood tide and high water. Fifty per cent of all closures occurred between 11 p. m. and dawn. The oysters closed tightly when the density of the water fell to 1,008 or below, and did not open until it had risen again to 1,010. They continued to feed in waters bearing as high as 0.4 gm. dry weight of suspended matter per liter. Although the summer was wet large numbers of oyster larvae were found, and on July 28, 1919, a high record of 45,500 larvae per 100 qt. of water was determined. Oyster larvae were observed to set continuously from July 30 to August 9, 1919.

DAIRY FARMING—DAIRYING.

Coconut meal as a feed for dairy cows and other live stock, F. W. WOLL (*California Sta. Bul. 335 (1921), pp. 241-258*).—The origin, composition, digestibility, and feeding value of coconut meal for dairy cows are discussed, and the results of two feeding experiments, in which coconut meal formed part of the ration, are presented. Brief notes are given on the value of coconut meal as a feed also for swine, poultry, and other farm animals.

In the first experiment three lots of eight cows each were fed a grain mixture composed of 300 lbs. wheat bran, 210 lbs. rolled barley, 200 lbs. cottonseed

meal, and 300 lbs. dried beet pulp. The cows received 7 lbs. of total concentrates per pound of butter fat produced, but in one lot 2 lbs. and in another 4 lbs. of this amount were coconut meal. The experiment was divided into two periods of six weeks each, in which the two lots receiving the different amounts of coconut meal were fed by the reversal method. All cows received alfalfa hay and sweet sorghum silage in addition to the grain rations.

The second experiment was conducted with two lots of six cows each, one lot receiving during the first period the regular grain mixture and during the second the grain mixture plus coconut meal, as well as alfalfa hay and silage, while for the second lot this feeding was reversed. The grain mixture consisted of 120 lbs. wheat bran, 140 lbs. rolled barley, 100 lbs. cottonseed meal, and 100 lbs. dried beet pulp. The grain was fed in the proportion of 7 lbs. per pound of butter fat produced, and when coconut meal was fed, 2 lbs. of the grain allowance were replaced by coconut meal for all cows except those fed 6 lbs. of total grain or more, which received 3 lbs. of the coconut meal per head daily, in place of a similar amount of the regular grain mixture.

The results of both experiments indicated that coconut-meal feeding has a tendency to increase the fat content of the milk slightly and to decrease the natural falling off in milk flow due to the progress of lactation. It is pointed out that the rations of coconut meal and mixed grain proved not only equal but somewhat superior to the standard mixture for milk production composed of barley, wheat bran, cottonseed meal, and dried beet pulp fed by the dairy-men of the State. The experience in connection with the experiment suggested that nearly all cows will eat 2 lbs. of coconut meal daily, but that a considerable number will refuse as much as 4 lbs. if supplied with a palatable grain mixture along with the meal.

Dairy cattle costs, F. T. RIDDELL and W. J. KURTZ (*Michigan Sta. Quart. Bul.*, 4 (1921), No. 2, pp. 51-53).—Data on the cost of maintaining cows for the year ended April 30, 1921, gathered from 23 dairy farms, showed that the average herd returns per cow over the direct costs amounted to \$91.91. An average of 7,104 lbs. of milk was produced per cow, testing 3.33 per cent of fat. Nine of these herds produced an average of 8,178 lbs. of milk per cow, making a net return of \$116.11, while 11 herds produced 6,218 lbs. of milk per cow, returning \$87.11 over direct costs. The feeding costs, labor distribution, investment, and average returns per cow are tabulated.

The heavy feeding of milch cows is now profitable, H. A. ROSS (*Illinois Sta. Circ.* 250 (1921), pp. 2).—Individual feed records of 528 cows, averaging daily 25 lbs. of 4 per cent milk from November to April, inclusive, showed a profitable increase in returns from the bran, corn, silage, and hay fed.

The water buffalo: A tropical source of butter fat, C. O. LEVINE (*Jour. Heredity*, 11 (1920), No. 2, pp. 51-64, figs. 9).—This paper deals with the use of the water buffalo, the Indian buffalo, and European cows as dairy animals in China, heat and gestation in the water buffalo, the characteristics of buffalo milk, and the diseases of the water buffalo in China. It consists of excerpts from the publication noted on page 573 with added illustrations. Milk analyses already noted from other sources (*E. S. R.*, 42, pp. 363, 771) are tabulated.

The water buffalo as a dairy animal, C. O. LEVINE (*Jour. Dairy Sci.*, 3 (1920), No. 5, pp. 340-352).—This includes some material not given in the publication noted above, particularly a more detailed account of the use of buffaloes in China and the Philippine Islands.

An agricultural tip from India, J. L. GOHEEN (*Calif. Univ. Jour. Agr.*, 7 (1921), No. 5, pp. 13, 32).—The author suggests a trial of the water buffalo as a dairy animal in California.

Effect of temperature of pasteurization on the creaming ability of milk, H. A. HARDING (*Illinois Sta. Bul.* 237 (1921), pp. 395-408, figs. 6).—The establishment of pasteurizing temperatures, the distinction between cream layer and cream line, and the practical importance of the cream layer are discussed, and the results of studies of the corrective effect of momentary heating upon the creaming ability of cold milk and of the destructive effect of higher and more prolonged heating are presented in tabular and graphic form. A brief description of measurements of creaming ability is noted above.

Milk at or below 50° F. given a momentary heating ranging from 85 to 142° showed a measurable increase in creaming power. Milk between 50 and 60° given a similar heating was little changed in this respect, and milk above 65° in temperature heated in the same manner showed a distinct decrease in creaming ability. It was found that milk with a comparable fat content when moderately heated is given a fairly comparable creaming power regardless of the agitation to which it has been exposed while cold.

The results of 401 tests of higher and more prolonged heating, while varying considerably, indicated that the volume of cream on milk begins measurably to decrease when the temperature of pasteurization rises from 142 to 144°. As the temperature goes higher the decrease in the volume of cream becomes rapidly more pronounced. At 145° it amounts to slightly more than 10 per cent, at 146° to 16.6 per cent, and at 148° to approximately 40 per cent by volume.

The relation of these results to the milk problem are discussed, and it is believed that an increase in the temperature of pasteurization above 145° for 30 minutes hardly seems justified in the absence of any evidence that a range from 142 to 145° is insufficient. It is pointed out that pasteurization is the most important protection against disease through milk but that the margin of safety should not be raised unnecessarily at the expense of the cream volume, thus tending to reduce the consumption of safe pasteurized milk because it is less acceptable to the public.

The measurement of the volume of cream on milk, H. A. HARDING (*Illinois Sta. Circ.* 249 (1921), pp. 3-16).—Methods of measuring the volume of cream are discussed, and the development of a method of measurement suited to milk plant conditions is described. Comparisons of various methods of measuring the creaming ability of milk are presented.

The newly developed method described consists of filling round-bottomed test tubes, 1 in. in diameter, to a depth of 204 mm. (8 in.) with the milk to be tested. These tubes are then cooled in ice water to 40° F. and held at that temperature for 24 hours. Each millimeter of depth in the resulting cream layer represents 0.5 per cent of cream by volume. It is stated that the volume of cream determined in this way agrees closely with the volume of cream developed in milk bottles under similar temperature conditions.

Testing milk, cream, and skim milk for butter fat, J. C. MARQUARDT (*California Sta. Circ.* 230 (1921), pp. 11, figs. 7).—This circular describes in a popular manner the method of using the Babcock test.

VETERINARY MEDICINE.

Manual of bacteriology, R. BRUYNOGHE (*Manual de Bactériologie. Paris: Gaston Doin, 1921, pp. 288, figs. 83*).—This manual contains a short section on general bacteriological methods, followed by separate chapters on various microorganisms pathogenic for man and for animals, each organism being considered under the headings of morphology, cultural characteristics, methods of diagnosis, and immunity. Chapters are also included on various parasitic fungi, spirochetes, trypanosomes, amoebas, and filterable virus.

Prophylaxis of animal diseases through immunity and disinfection, W. FREI (*Prophylaxis der Tierseuchen durch Immunität und Desinfektion. Berlin: Richard Schoetz, 1921, pp. VIII+272*).—This handbook presents in concise form a survey of the literature on the control of animal diseases. A general section on infectious diseases and immunity is followed by sections on immunity reactions classified as serodiagnostic and allergic reactions, the destruction of pathogenic organisms by disinfectants, and the inhibition of the growth of pathogenic organisms in susceptible animals through active and passive immunization. The last-named section includes separate subsections on the active and passive immunization of anthrax, blackleg, glanders, hog cholera, contagious abortion, rinderpest, foot-and-mouth disease, and other animal diseases. Extensive references to the literature are given as footnotes.

Chemotherapeutic studies with fats and cultures of acid-fast bacilli, A. LINDENBERG and B. R. PESTANA (*Ztschr. Immunitätsf. u. Expt. Ther., I, Orig., 32 (1921), No. 1, pp. 66-86*).—While this is largely a study of the mechanism of the action of chaulmoogra oil in leprosy, a brief investigation is reported of the action of chaulmoogra, cod liver, and linseed oils in human and experimental guinea pig tuberculosis.

The authors are of the opinion that chaulmoogra and other oils possess through their content of unsaturated fatty acids a highly specific, growth-inhibiting action on cultures of tubercle bacilli and other acid-fast organisms. This is thought to explain the well-known action of chaulmoogra oil in leprosy and of cod liver oil in certain cases of tuberculosis. These oils are thought to act as direct chemotherapeutic reagents and not as a stimulant to phagocytosis or as a tonic. Whether the activity is proportional to the number of double bonds in the acid molecule or to new unknown, unsaturated acids has not yet been determined.

The use of normal beef serum in experimental anthrax infection, R. KRAUS and P. BELTRAMI (*Rev. Inst. Bact. [Argentina], 2 (1921), No. 6, pp. 249-264*).—The question of the protective property against anthrax of normal beef serum (E. S. R., 40, p. 582) has been further studied by tests of its protective power against experimental anthrax in rabbits and guinea pigs, with conflicting results. Since conflicting results were also obtained with immune serum, the authors are inclined to retain their belief in the efficacy of normal beef serum. Reference is made to the paper of Kolmer et al. (E. S. R., 42, p. 475), in which the conclusion was drawn from experiments with white mice that normal beef serum is but feebly curative. The authors are of the opinion that the unfavorable results obtained by Kolmer were due to the great susceptibility of mice to anthrax, and that equally unfavorable results would have been obtained with the use of immune serum. Experiments in confirmation of this are cited.

Immunization and therapy of experimental blackleg, E. RAVENNA (*Clin. Vet. Russ. Polizia Sanit. e Ig. [Milan], 44 (1921), No. 20, pp. 573-582*).—Attempts to immunize guinea pigs against experimental blackleg infection with filtered toxin are reported, with variable and uncertain results. The Leclainche-Vallée antiblackleg serum gave good results as a therapeutic agent in experimental blackleg in guinea pigs, but another specific immunizing serum proved ineffective, as did normal bovine serum and sodium acid caseinate, considered by some to have curative properties.

Résumé of experiences with foot-and-mouth disease, E. ROUX, H. VALLÉE, H. CARRÉ, and NOCARD (*Compt. Rend. Acad. Sci. [Paris], 173 (1921), No. 23, pp. 1141-1145*).—This paper consists of notes on the authors' experience in the study of foot-and-mouth disease in France since 1901.

As the source of virus, blood obtained at the height of the fever is considered preferable, and defibrination instead of the use of anticoagulants is recommended. It is stated that this defibrinated blood can be kept in the ice box at a temperature of from -1 to -2° C. for two or three months without losing its virulence. It is noted, however, that dilution with water or physiological salt solution renders the virus very unstable.

The blood of diseased animals contains less virus than the lymph or serous exudates, while the epithelium from the skin lesions is more virulent than either blood or lymph. Lymph rapidly desiccated in vacuo has been found to remain virulent at room temperature for 7, 11, and 18 days.

Aside from intradermal and intramuscular inoculation, which is difficult to accomplish, and intravenous inoculation, which is sometimes uncertain in its results, all experimental methods of infection have produced less severe forms of the disease than that naturally acquired, the lesions being located in the mouth only. As a method of immunization, subcutaneous injection of 1 cc. virulent blood serum, stabilized by having been kept in the ice box for at least a month, is recommended. The immunity thus acquired is, however, of very short duration.

Glanders, J. BAGUÉ (*Porto Rico Dept. Agr. and Labor Sta. Circ. 42* (1921), *Spanish ed.*, pp. 3-6, pls. 2).—A brief summary of information illustrated by colored plates.

Piroplasmiasis, or Texas fever, J. BAGUÉ (*Porto Rico Dept. Agr. and Labor Sta. Circ. 45* (1921), *Spanish ed.*, pp. 3-5).—A brief summary of information.

Rinderpest in Belgium, J.-B. PIOT BEY (*Bul. Inst. Égypte, 3* (1920-21), pp. 61-66).—This is a general discussion of the best means of combating rinderpest under different conditions. The slaughter of infected animals is considered brutal and unnecessary, and confining infected herds in stables is also considered unwise. Isolation of the infected animals under strict supervision is considered the best means of controlling the spread of the disease.

Notes on rinderpest in French West Africa and in Poland, G. CURASSON (*Rev. Gén. Méd. Vét.*, 30 (1921), No. 358, pp. 569-590, figs. 12).—This paper consists of notes on various phases of rinderpest as studied under such widely different conditions as exist in West Africa and in Poland.

Attention is first called to the importance in the production of serum for immunization of using the blood of infected animals at the time of the initial thermal reaction before the appearance of external lesions. If the blood is taken at any time during the course of the disease, the results with the inoculated animals will be variable and unreliable. Even with a stable virus the reaction is apt to take different forms, varying with the resistance of the inoculated animal. Several typical variations are noted.

Failure to obtain complement deviation, precipitation, and agglutination reactions with the blood of animals suffering or recently recovered from the disease is reported.

Leucocyte counts made on the blood of animals in different stages of the disease showed no change in the number of leucocytes during the first four days and then a gradual decrease, commencing with the appearance of fever and continuing until the animal dies or begins to recover. In the latter case the lowest point is reached in 11 or 12 days, and by about the 20th day the number of leucocytes becomes normal. A decided increase in the number of erythrocytes in the blood during the first days of the fever is customary, this increase being particularly marked in the case of young animals.

Four calves aged, respectively, 11, 7, 3, and 1 days, born of hyperimmunized mothers but receiving milk from a cow immunized only by an injection of

serum, proved refractory to an injection of 5 cc. of virus. Attempts to infect adult animals by the injection of small doses of virus showed the minimum infective dose to be about 10 cu. mm.

The use of bile instead of serum as an immunizing agent was attempted on several occasions in Poland with less satisfactory results than had been reported from West Africa.

The subcutaneous injection on the second day of the fever of from 20 to 50 cc. of the animal's own blood was found in 6 out of 15 cases to prolong considerably the period of fever and postpone the appearance of the second phase of the reaction. This is thought to be of possible practical interest to serum producers in thus lengthening the time in which the animal can be used for virus.

The urine of animals suffering from the disease proved to be virulent the day following the appearance of the fever and to be still virulent on the ninth day, but to lose its virulence more quickly than the blood.

A study of the immunizing properties of the milk of hyperimmune cattle is summarized as follows: The milk contains the same antibodies as the blood serum, but in a smaller proportion. The milk serum is less active than whole milk. Milk seems to have its greatest activity 12 days after a reinjection of virus. Preservation does not alter the properties of milk. In considering the question of the practical application of milk as an immunizing agent, obstacles to its utilization are cited. These include the impracticability of using the amount of milk that would be necessary for immunization, the varying activity of milk during the period of lactation, and the difficulty of keeping milk for such lengths of time as would be necessary in its practical use. Of possibly greater feasibility would be the use of milk of an animal recently cured of the disease.

In discussing the question of possible carriers of rinderpest virus, it is indicated that lesions in the vagina may possibly serve as a source of infection.

Contribution to the study of bile-treated tubercle bacilli, A. CALMETTE, A. BOQUET, and L. NÈGRE (*Ann. Inst. Pasteur*, 35 (1921), No. 9, pp. 561-570).—The object of the present study was to observe the effects of bile-treated cultures of bovine tubercle bacilli (*E. S. R.*, 30, p. 482) on various animals, other than cattle, sensitive to tuberculous infection. Guinea pigs, rabbits, dogs, monkeys, and horses were used as the experimental animals, and injections were made subcutaneously, intraperitoneally, and intravascularly (by puncture of the heart wall).

A single inoculation of the bile-treated bacilli into healthy animals was well borne except in the case of the horse, which proved more sensitive than laboratory animals. In no case, however, were typical tubercular lesions found although the bacilli were present in the blood. It was found possible to inject 25, 50, or even 100 mg. of the bile-treated bacilli in a volume of 1 cc. intravascularly in guinea pigs without producing tubercular lesions.

Repeated injections of the culture produced no tuberculin-like reactions but a typical infection, in the course of which there was a progressive increase in the number of lymphocytes and mononuclear cells with a parallel diminution in the number of polynuclear cells. Injection of bile-treated bacilli, even in massive doses, into the animals already tuberculous caused no aggravation of the malady.

Experiments to determine whether bile-treated bacilli confer any resistance in guinea pigs toward virulent tubercle bacilli gave results indicating that inoculation into the blood stream or a single intracardiac inoculation conferred considerable protection.

Researches into the serological diagnosis of contagious pleuropneumonia of cattle, G. G. HESLOP (*Roy. Soc. Victoria Proc., n. ser., 33 (1921), pp. 160-211*).—This is the report of an extensive investigation of contagious pleuropneumonia of cattle, with particular reference to its serological diagnosis.

Following a brief review of the literature on the disease, preliminary cultural and filtration experiments are reported. It was found that Martin's peptone bouillon with the addition of 7.5 per cent of normal ox serum is the best medium in which to obtain primary cultures of the organism involved. Growth takes place under aerobic conditions with an optimum incubation temperature of 37° C. Cultures thus obtained are capable of filtration through a Chamberland F. filter candle if the culture is first diluted with from 1 to 2 per cent of Martin's broth (without serum). Growth in Martin's broth serum media is recognizable after approximately 21 days by slight opalescence, for the recognition of which it is necessary that uninoculated tubes of the same broth be incubated at the same time. Animal inoculation should be used to confirm the identity of the organism.

The agglutination test was found to be without value in the diagnosis of the disease, but the complement fixation test, if carried out by the special technique developed by the author, yielded reliable results. The main difficulty in carrying out complement fixation tests for the diagnosis of contagious pleuropneumonia is thought to be the prevention of errors arising in the test owing to the presence of conglutinin in the serum. Since the amount of conglutinin present in bovine sera differs very considerably, it is necessary to titrate each test serum separately to determine the proper quantity to use in the final test. An alcoholic extract of subepidermal tumor tissue from a diseased animal is considered the most suitable antigen.

White diarrhea, J. BAGUÉ (*Porto Rico Dept. Agr. and Labor Sta. Circ. 46 (1921), Spanish ed., pp. 3, 4*).—A very brief account of this affection in calves.

The susceptibility of swine to contagious abortion, *Bacterium abortus*, I. F. HUDDLESON (*Michigan Sta. Quart. Bul., 4 (1921), No. 2, pp. 43-45*).—Two series of experiments conducted to determine the susceptibility of swine to *B. abortus* infection are reported, the results of which would seem to indicate that swine possess a high degree of immunity toward this specific organism. After feeding periodically both naturally infected milk and virulent cultures of *B. abortus* to three pigs from the age of eight weeks until they farrowed, no reaction to the blood tests for contagious abortion could be obtained and none of the sows aborted. In the second experiment, attempts to infect swine were made through feeding naturally infected milk and through daily association with cows known to be carriers of the abortion bacilli. Negative results were again obtained.

Swine dysentery, R. A. WHITING, L. P. DOYLE, and R. S. SPRAY (*Indiana Sta. Bul. 257 (1921), pp. 15, figs. 9*).—During the course of the past few years, when the traffic in feeder hogs has been unusually heavy, a disease characterized by definite symptoms and lesions and known as bloody diarrhea has appeared, causing heavy loss to hog feeders. Both young and old hogs have been affected, the most serious outbreaks occurring on farms where stockyard feeder hogs were fed.

The earliest symptoms occurring in these stockyard feeder hogs were manifested 5 to 14 days after they arrived on the farm. All of the animals, however, were not affected, and the progress of the disease in the herd was usually slow. Field outbreaks showed variable periods of incubation, the shortest being 7 days and the longest 60 days. In the exposure experiments the shortest incubation period was 4 days and the longest 12 days. The first

symptoms observed were elevation of body temperature, twitching of the tail, standing with head down, or lying on the sternum. While young hogs that died early in the disease showed very little emaciation, weakness and emaciation were very marked in the later stage of the disease. There was no discharge from the eyes such as occurs in hog cholera. The course of the disease varied from 3 days to 2 weeks. The so-called chronic form was common in young hogs, the animals becoming stunted and unthrifty. The death rate in young hogs varied from 40 to 60 per cent and in feeder hogs from 10 to 20 per cent, while the average death rate on farms where the infection persisted for a period of from 1 to 2 years was about 25 per cent.

"Upon post-mortem examination the majority of carcasses showed emaciation. This condition was less pronounced in the hogs that died early in the course of the disease. In these early cases the pathological changes consisted of blood engorgement and hemorrhage, which were limited to the mucosae of the stomach, caecum, colon, and rectum. The mucosa of the small intestines was less frequently involved and to a lesser degree. The more advanced cases were characterized by varying degrees of diffuse necrosis of the mucosae of the stomach, caecum, colon, and rectum. The necrotic mucosa varied in color from grayish yellow to slate color. Frequently the necrosis extended into the submucosa and muscular coats, with a tendency to slough, leaving a granular surface. A semifluid exudate, which contained a high content of mucus mixed with blood, covered the necrotic surfaces."

A histo-pathological study of the stomach and the colon is reported upon, and the history is given of three field outbreaks. This is followed by a report of experimental and bacteriological studies of the affection. The studies show the causative organism to be present in the intestinal discharge of pigs sick of the disease, and that while virulent strains of *Bacillus suispestifer* were frequently isolated from tissues of hogs dead of the disease it is not the actual cause but acts as a secondary invader.

The most successful treatment practiced in controlling field outbreaks included the feeding of a very light ration, and the removal from the herd of hogs that showed visible symptoms and the withholding of such feeds as tankage and grain from these animals. The well and apparently well hogs were allowed to run in blue grass or clover pasture where they would have wide range. Several outbreaks were controlled in this manner. No success was met with in controlling the disease in suckling pigs. In the experimental pens the virus died quickly unless sick pigs were present. The manner in which the virus is carried over from year to year has not been determined, but the history of several outbreaks indicates that brood sows may act as carriers.

A complete study of contagious epitheliosis, H. R. LEWIS (*New Jersey Stat. Rpt. 1920, pp. 119-121*).—A study of the treatment and prevention of the roup, chicken pox, and canker group of diseases of fowls is summarized briefly. The investigation was carried on at about 30 different poultry farms in various counties of the State. On the average 200 birds were used in each experiment, 100 being vaccinated and 100 kept as controls. One cc. of the vaccine constituted the usual dose, the inoculation being made under the skin on the breast.

Vaccine prepared from actual cases from a given flock and used on the same flock gave fairly good results, especially when a double dose was administered and repeated after 6 days. The value of the vaccine when applied previous to the appearance of the disease was questionable. It is thought that this may have been due either to the worthlessness of the vaccine, the short time in which it may have a protective value, insufficient dosage, insufficient strength of vaccine, or other unrecognizable factors. There was, however, sufficient indication of protective value in the vaccine to warrant further study.

Bacillary white diarrhea of fowls, H. J. STAFSETH (*Michigan Sta. Quart. Bul.*, 4 (1921), No. 2, pp. 41, 42).—This paper describes the characteristic features of bacillary white diarrhea of fowls, the method of conducting the agglutination test for its detection, and precautions that must be taken to prevent the disease from spreading.

Control of bacillary white diarrhea, H. R. LEWIS (*New Jersey Stas. Rpt.* 1920, pp. 127-131).—A brief summary is given of the results obtained by Rettger et al. at the Connecticut Storrs Station in their studies of bacillary white diarrhea of young chicks and an outline of the method of conducting the agglutination test as recommended by Rettger. This test, conducted on 100 breeding hens, gave positive results with 9 birds, and these results were confirmed by post-mortem examinations. The remaining negative reactors have been used as a basic breeding flock with encouraging results, all traces of the disease having disappeared from the flock in question.

Suggestions for the handling of baby chicks where the presence of the disease is suspected are included.

Observations concerning the distribution and prevalence of poultry disease in New Jersey, H. R. LEWIS (*New Jersey Stas. Rpt.* 1920, pp. 122-127).—A list of poultry diseases diagnosed by the station is given, and some of the findings are discussed.

RURAL ENGINEERING.

Irrigation and irrigation farming in tropical Africa, Y. HENRY and J. LEMMET (*Irrigations et Cultures Irriguées en Afrique Tropicale. Paris: Émile LaRose, 1918, pp. V+296, pls. 11, figs. 35*).—This book deals with both the technical and practical phases of the use of water for irrigation in the colonies of French West Africa.

The first part presents the results of studies of the formation and régime of the soils and waters of the Senegal River Valley, which is considered to be typical of the great African alluvial valleys. This study deals in detail with rainfall, floods and flood control, evaporation, and topography. A supplementary study of a similar nature of the Guiers Basin is also presented, owing to the relatively large area of irrigable soils therein. Conditions on the coast of Lower Guinea are also discussed, with particular reference to the factors involved in rice irrigation.

In the second part the conditions and factors involved in irrigation farming in the region are discussed, with particular reference to soil water and crops with regard to their respective and relative values. The results of a study of the physical and chemical composition, cultural qualities, and fertility resources and requirements of the soils of the Senegal River Valley and of the Guiers Basin are presented, and a comparison is drawn between these soils and those of the Nile Valley. Practical information on the management of such alluvial soils is given. A chapter on water brings out the necessity for irrigation in the region, and gives the detailed results of studies of methods of applying irrigation water. A final chapter summarizes irrigation farming in the region, drawing attention to the practices best adapted to the different crops, the more important of which include rice, cereals, cotton, and legumes.

The winning, preparation, and use of peat in Ireland—reports and other documents (*London: Dept. Sci. and Indus. Research, Fuel Research Bd., 1921, pp. 76, pls. 10*).—This is a report of the Fuel Research Board of the Department of Scientific and Industrial Research of Great Britain on the general peat problem in Ireland. The investigation dealt mainly with the obtaining of peat for fuel and for the development of power and the agricultural reclamation of stripped peat bogs.

The conclusion is drawn that peat fuel may be obtained in Ireland on a scale sufficient to warrant the establishment of electric power stations at one or more of the most favorably situated bogs, and that such a scheme should be associated with the reclamation of the bog for agricultural purposes. It is shown that the economic obtaining of peat on such a scale is dependent upon the use of machinery, which should be electrically driven. In addition it is pointed out that electricity would also be available for agricultural purposes.

The opinion is expressed that sufficient peat to provide a steady output of 100,000 tons of air-dried fuel annually can be obtained mechanically from a selected bog area, and can be air-dried to from 25 to 35 per cent moisture content in an ordinary season in Ireland. It is recommended that such an enterprise be initiated by the State, and that systematic drainage of the bog be carried out so as to render it fit also for agriculture.

Seven appendixes dealing with technical and agricultural phases of the subject are included.

The "know how" of concreting, H. C. CAMPBELL (*Nehawka, Nebr.: Sheldon Mfg. Co., 1921, 2. ed., pp. 127, figs. 82*).—General information is given on the methods of construction of a number of common concrete structures, especially around the farm.

Annual report of the Department of Public Highways, Ontario, 1919, F. C. BIGGS (*Ontario Dept. Pub. Highways Ann. Rpt., 1919, pp. 100, pl. 1, figs. 10*).—This report includes data on the work and expenditures of the Department of Public Highways of Ontario for the year 1919.

Suction gas plants and engines, W. S. H. CLEGHORNE (*Union So. Africa Dept. Agr. Jour., 3 (1921), No. 4, pp. 317-333, figs. 8*).—General information on the theory, construction, and operation of suction gas plants and engines is given, together with separate notes on their operation. It is stated that it is difficult to learn to run a suction gas plant, and that such a plant is expensive to install. It is pointed out, however, that such plants are at present extensively used by farmers in South Africa for pumping irrigation water. The economy of the plant is one of its main advantages, especially in the matter of fuel.

A new hydraulic apparatus for measuring tractive effort, M. W. POLAK (*Meded. Landbouwhoogesch. [Wageningen], 21 (1921), No. 3, pp. 48, pls. 5, fig. 1*).—This report deals with traction dynamometers in general and hydraulic and spring types especially. Comparative experiments with different types indicated that in a comparison of the reliability of similar dynamometers, experiments should be made with the two instruments connected in series. These should yield the same results in several trials, and any marked variation in results is taken to indicate the unsuitability of the apparatus.

Experiments with spring dynamometers showed that they do not indicate a lower tractive effort than the actual, as is generally supposed. A new hydraulic dynamometer is described, the principle of which is based upon the relation between the pressure upon a liquid and the quantity of it which will flow out of an opening of a given size within a given time. The instrument consists of a cylinder and piston, with a 10-cm. stroke and diameter, a high-pressure rubber tube, and a measuring apparatus. When in operation, water is permitted to flow under pressure from a small opening into a glass measuring tube. The quantity of water flowing into the tube in a given time gives a direct measure of the average tractive effort, and duration of time is measured precisely as the opening and closing of the tap is automatically controlled by a chronometer.

Comparative experiments with hydraulic and spring dynamometers are reported, leading to the conclusion that there is no special traction dynamometer

available which can be used in comparative studies of traction with absolute accuracy. In all the instruments studied the necessity for determining maximum variations in results was evident. However, the hydraulic instruments yielded far better results than those working on the spring principle, and had the further advantage of indicating the average tractive effort directly.

Wheel attachments show increased drawbar pull (*Agrimotor*, 5 (1921), No. 2, pp. 7, 8, figs. 5).—In a contribution from the Indiana Experiment Station, the results of experiments on three types of stationary metal shoes for tractor drive wheels are briefly presented. One type permitted an increase in drawbar pull under difficult conditions of 22 per cent over the ordinary tractor wheel.

Loading bag maize in railway trucks, C. P. ROBINSON (*Rhodesia Agr. Jour.*, 18 (1921), No. 5, pp. 498–503, figs. 4).—Information and diagrammatic illustrations are given on the methods of loading bags of maize in freight cars.

Stress-strain measurements on films of drying oils, paints, and varnishes, H. A. NELSON (*Amer. Soc. Testing Materials Proc.*, 21 (1921), pp. 1111–1134, figs. 12).—Methods and apparatus for making stress-strain measurements of paint and oil films are described, and the results of actual tests are reported to show the properties of films and their modification under the influence of moisture and temperature variations, light, and other agencies. It was found that width of test specimens is not a factor in the numerical results of a test, provided the rate at which the load is applied is calculated to the same number of grams per square centimeter of cross-sectional area per minute.

Duplication of thickness over any considerable area is largely a matter of chance. It was found that films of varnish and enamel are more uniform in thickness than paint films.

The ultimate elongation varies inversely, and the ultimate tensile strength varies directly as the rate of application of the load. Curves indicating the relation between ultimate tensile strengths and rates of loading showed that (1) the slopes of the curves vary directly as the ultimate tensile strength, (2) within the most practical working range of from 10,000 to 30,000 gm. per square centimeter per minute, the relation is practically linear, and (3) the ultimate tensile strength at infinitely slow rates may be rather easily obtained by extrapolation from observations made at three or four different rates. A rate of loading of 15,000 gm. per square centimeter per minute was found to be the optimum for ordinary tests.

The moisture absorbed by paint films will vary in amount, depending upon the age of the film and its composition, the maximum found being about 2 per cent by weight. Much qualitative evidence was obtained that changes in temperature affect the physical properties of films to a considerable extent. For testing purposes 25° C. was accepted as a standard temperature for desiccation and for the atmosphere surrounding the testing apparatus.

Studies of actual stress-strain curves of enamel, paint, oil, and varnish mixtures and of rubber for comparison showed them to be of parabolic form, corresponding to the formula $y = ax^n$, in which y = strain, x = stress, and a and n are constants depending upon the stage of oxidation attained by the film. The data indicate that within experimental error the freshly formed linseed-oil film approximates perfect elasticity. They also show that (1) in the presence of oxygen the entire process of the appearance of the solid phase when a drying oil takes on structure is normally progressive; (2) the highly unsaturated compounds in the oil will undergo most rapid oxidation; and (3) as oxidation proceeds the film becomes more resistant to distortion and generally loses its high elastic property.

The paint film may be considered in a similar manner, but the enormous surfaces exposed by the pigment and the small interparticle distances encourage rapid oxidation, with the result that the oxidized solid phase in a few days reaches a stage of oxidation which requires months on the part of a film of ordinary bodied linseed oil, unless under the influence of a catalyst. If the paint film ever approaches perfect elasticity and obeys Hooke's law, it must be very early in the stage of oxidation.

Varnish vehicles are usually so treated during the process of manufacture and incorporation that extensive oxidation of a portion of the vehicle has already taken place. Also, the colloidal gums present expose tremendously greater surfaces to the oxidizing binder, resulting in higher resistance to distortion at an early stage in the life of the film.

China wood oil exterior varnishes present a variation from the above. There appears the same increased resistance to distortion at early stages, and also the same accelerated distortion throughout the upward sweep of the stress-strain curve. But instead of breaking off short, the remaining structure, which has retained its high extensive properties, having submitted to distortion to the limit, shows sufficiently high tenacity or structural property to resist final rupture.

"All of the evidence and argument so far presented makes the presence of any measurable elastic limit in films of highly oxidized linseed oil and any paint or varnish seem improbable. At most, the true elastic limit can only be that of the most highly oxidized material which will attain its elastic limit first."

During investigations of variations in the form of the stress-strain curve, increasing evidence was obtained that by abnormal treatment with moisture and temperature variations, films can be made to deviate entirely from the normal stress-strain curve.

It is concluded that the amount of distortion to which a film will submit before rupturing appears to be a characteristic property depending on the components of the film and the stage of oxidation or deterioration, and therefore can not be considered to any extent apart from specific tests. Films of common paints and varnishes generally lose in ultimate elongation and gain in tensile strength as normal oxidation proceeds. Notable exceptions to this have been observed, however, in the case of better grade varnishes, which will often hold a very constant ultimate elongation throughout a long period of oxidation during which time the tensile strength increases steadily.

Test of a fan system of ventilation for dairy barns, M. A. R. KELLEY (*Agr. Engin.*, 2 (1921), No. 10, pp. 203-206, figs. 5).—One of a series of studies conducted during the winter of 1920-21 on a number of farm building ventilating systems in different States by the Bureau of Public Roads, U. S. D. A., in cooperation with the American Society of Agricultural Engineers and the South Dakota Experiment Station, is reported.

The object of this study was to determine the factors which influence the operation of barn ventilating systems. The circulation of air in the barn under test was obtained by the use of a fan connected with an electric motor. The system was newly installed by the South Dakota Station and was tested during the middle of January, 1921, in quite mild weather. The roof of the barn was of the full monitor type. The main part of the barn was protected on the northeast and northwest sides by sheds. The windows were 12-light, double hung, and were provided with storm sashes on the north and west sides. The walls were of frame construction with drop siding on 2 by 6 in. studs. The barn was well filled with stock, consisting of 29 mature cows and

21 head of young stock. It was found that the total average heat produced in this barn of 136,700 B. t. u. per hour is equivalent to the average heat produced by 45.5 cows weighing 1,000 lbs. each.

The fan housing enclosed a 24-in. electric fan. The motor was rated at $\frac{1}{4}$ h. p., 850 revolutions per minute, and 220 volts. The outer opening of the fan casting was fitted with weighted shutter vanes. Two small sliding doors, 11 by 13 in., one above each flue at the point of connection with the fan box, provided a means of decreasing the amount of air drawn through the flues. It was found that by opening the doors fully the amount of air drawn from the stables could be decreased approximately 27 per cent.

As the total heat lost by ventilation and radiation decreased, the temperature inside increased. The average ceiling temperature for the two days of the test was 50.7° F., the floor temperature 47.7°, and the average room temperature 49.4°. It is estimated that in this barn 43.7 per cent of the heat generated by the animals was lost by ventilation, and 23.5 was lost by radiation. The balance minus any leakage loss was available for warming the room. The total consumption of electric current for the period was 2.3 kw. hours, or at the rate of 0.16 kw. per hour.

Flue-curing tobacco barns and packing house, A. C. JENNINGS (*Rhodesia Agr. Jour.*, 18 (1921), No. 5, pp. 529-533, pls. 3).—This is a revision of an article previously noted (*E. S. R.*, 42, p. 489).

A farm ice house, F. E. FOGLE (*Michigan Sta. Quart. Bul.*, 4 (1921), No. 2, pp. 56-58, fig. 1).—Simple drawings showing the construction of an ice storage house are presented.

Investigation on soil pollution and the relation of the various types of privies to the spread of intestinal infections, I. J. KLIGLER (*Rockefeller Inst. Med. Research Monog. No. 15* (1921), pp. 75, figs. 3).—Investigations are reported on the various types of privies in use, particularly with regard to the danger of soil pollution and its relation to the spread of intestinal infections. Special attention was given to the pit and septic types of privy, although other varieties, particularly the pail and chemical closets, were also studied.

Repeated tests were conducted in the laboratory to determine (1) the viability of the typhoid and dysentery bacilli in soil and in excrement under different conditions, (2) their ability to penetrate through columns of soil of different porosity, (3) their viability in septic fluids and effluents, and (4) the nature of the antagonistic factors in soil and septic material which influence the viability of these microorganisms. In the field work various types of privies of different ages were examined, particularly with regard to the extent of pollution of the soil surrounding these privies, their relation to well pollution, and the passage of material from the privies through the soil to adjoining wells.

It was found that the typhoid and dysentery bacilli succumb rapidly on exposure to an unnatural environment. Both bacilli died out in from one to five days in septic tanks. It is thought that the typhoid bacilli may survive in solid feces for a period of from 10 to 15 days, while the dysentery bacilli were found to rarely survive longer than five days. The para-typhoid bacilli were the most resistant members of the group, and the Shiga dysentery bacillus was the most sensitive. The survival period of these organisms in soil was greater than in either feces of septic fluids and normally varied, particularly with the moisture and reaction of the soil, although temperature affected the viability. In moist, natural soil, with a pH value of from 6.6 to 7.4, the typhoid and dysentery bacilli were recovered up to 70 days. In the same soil, dry, the bacilli were not recovered after two weeks. In moist, acid soils, with a pH

value of from 4.8 to 5.4, 90 per cent of the inoculated bacilli died out within the first 10 days. The others survived as long as 30 days. All the organisms survived longer near freezing temperature (4° C.) than at higher ones (20 to 37°). The antagonistic action of soil bacteria on typhoid and dysentery bacilli was found to be due largely to the alkaline reaction resulting from their metabolism. Specific inhibitive substances were, however, elaborated by some soil bacteria, notably *Bacillus fluorescens* and *B. proteus*.

The spread of pollution from a focal point was found to be limited in scope. Typhoid and dysentery bacilli under experimental conditions were not observed to spread laterally to any appreciable extent, although they were carried vertically through a column of 2 ft. of porous soil. In denser soil they failed to penetrate through 1 ft. In the field, where the subsoil was free from pollution, either near pit privies or near tile pipes from septic tanks, contamination extended downward to a depth of from 3 to 5 ft., and laterally only about 3 ft. from the bottom of the pit or tiles. It is thought that heavy rains or constant dripping of water may carry surface pollution to a depth of 10 ft.

Pollution of wells is concluded to be usually surface in origin. There was no correlation between the type or proximity of the privy to the degree of contamination of the adjacent wells. The purity of the well water varied rather with the condition of the well. Driven shallow wells with pumps were, as a rule, free from contamination, while dug wells with pumps or buckets were generally grossly polluted. Experiments with fluorescein failed to show subsoil pollution of wells from privies, but proved in some instances at least the possibility of surface contamination.

The general conclusion is drawn that in moderately compact clay, sand clay, or sandy soil free from cracks, the possibility of subsoil pollution of ground water is negligible, provided the ground-water level is more than 10 ft. below the polluted area. "The pit privy can be used safely in any soil similar in character to those studied in the course of this investigation, provided the ground-water level does not rise higher than 10 to 15 ft. from the surface. In such soils a pit about 3 ft. deep would be within the limits of safety if properly protected against flies. The cheapness and the relatively little care that it requires would recommend it in certain communities.

"In limestone regions and in soil where the water table is near the surface the pit privy should not be considered safe. In such localities the Kentucky sanitary privy or one of similar design might be recommended. This type of privy should have a sufficient storage capacity to allow time for the destruction of pathogenic bacilli, approximately five days. If that precaution is taken, there should be very little danger of infectious material passing from the drains to the ground water, especially if there is a layer of soil of about 5 ft. between the drain and the ground-water level. The drain pipe should also be placed about 2 ft. below the surface.

"In general it should be emphasized that any form of subsoil disposal should be designed with a knowledge of the character of the soil and particularly with due regard to the ground-water level. The vertical distance between the source of pollution and the ground water is the significant factor. The horizontal distance between the source of pollution and the well is of relatively slight importance except when there are underground channels or cracks in the soil."

Soil and water pollution, W. A. HARDENBERGH (*Pub. Works*, 51 (1921), No. 27, pp. 497-499).—A summary of the results of studies from different sources is given on the pollution of soil and water supplies, from which the conclusion is drawn that the type of soil and the depth of the water table are highly important factors. It is further concluded that, with the knowledge available, the border-line cases of high water table and unfavorable soil conditions should

be considered dangerous, and that types of sewage-disposal systems, liable to pollute the ground water, should be avoided as much as possible. Shallow wells, drawing from ground waters exposed to such pollution, should also be avoided or at least kept under close scrutiny.

RURAL ECONOMICS AND SOCIOLOGY.

Principles of national economy, T. N. CARVER (*Boston and London: Ginn & Co., 1921, pp. VI+773, figs. 18*).—This is a philosophic discussion of factors of national prosperity covering economic institutions, habits and policies of production, exchange, distribution, consumption, and public finance. Various reforms are discussed in chapters dealing with labor programs, socialism, communism, anarchism, the single tax, the limits of State interference, and constructive liberalism.

America's domestic food supply, R. G. SKERRETT (*Sci. Amer., 126 (1922), No. 1, pp. 5-7, figs. 9*).—The author takes an inventory of food requirements in the United States and the extent to which they are met by home production. Statistics are graphically illustrated.

Report of the Bureau of Economics and Social Intelligence and its program, LOUIS-DOP (*Inst. Internatl. Agr. [Rome], Com. Perm., Proc. Verb. 1920, pp. 415-437*).—An outline is given of the proposed plan for the annual publication of this bureau, as well as for its monthly bulletin, monographs, bibliography, and a vocabulary for economics and sociology.

[Farm management investigations] (*New Jersey Stas. Rpt. 1920, pp. 258-264*).—Investigational work along lines of cost of producing farm products has been carried on by A. G. Waller, employed cooperatively by the New Jersey State Experiment Station and the U. S. Department of Agriculture.

Cost of producing can-house tomatoes.—In addition to some tables which have been noted from another source (*E. S. R., 45, p. 796*), one is included here showing the cost per ton, 1919 and 1918, in seven groups ranging from \$40 or less to \$130 plus in 1919 and from \$14 or less to \$40 plus in 1918.

Cost of producing potatoes.—This brief report is concerned with the cost of producing the commercial crop in Monmouth, Salem, and Cumberland Counties, N. J., in 1919. The acre cost varied from \$185.90 in Monmouth County to \$165.26 in Salem and \$179.61 in Cumberland, the yields per acre being 69.5, 48.1, and 52.58 bbls., respectively.

Cost of producing truck in Copiah County, 1921, J. N. LIPSCOMB and M. E. ANDREWS (*Mississippi Sta. Circ. 39 (1921), pp. 4, figs. 3*).—The gross cost of producing one acre each of tomatoes, cabbage, peas, beans, and carrots in 1921 and the sales from one acre of these crops compared with the seven-year average are charted. The days of man labor required for an acre each of a number of truck crops are similarly illustrated. Detailed costs are listed for each of the crops named showing averages on from 2 to 16 farms in the county.

The cost of production of farm products, W. C. JENSEN (*Clemson Agr. Col. S. C., Ext. Bul. 49 (1921), pp. 29, figs. 4*).—This discussion is intended to illustrate the usual elements of cost and how to apply them in an analysis of the cost of production of important South Carolina crops—cotton, corn, peanuts, and oats.

A three-year farm management survey of truck farms in Gloucester County, N. J., G. A. BILLINGS and L. G. HOWELL (*New Jersey Stas. Rpt. 1920, pp. 266-315, figs. 14*).—This is the report on a study of 125 farms in the western part of Gloucester County covering three years, 1914 to 1916, inclusive. A record of the year's business on these farms, from March 1, 1914, to March 1, 1915, was obtained, together with an inventory of the farm investment for the

beginning and the end of the farm year. This was repeated in the two succeeding years, the records being taken in March or just at the close of the farm year.

These farms averaged 80.8 acres, of which 53.3 acres were in crops. Twenty-two per cent of the crop area was in hay and small grain, 18.6 per cent in field corn, 22.2 per cent in sweet potatoes, 16.8 per cent in early tomatoes, 5.1 per cent in early white potatoes, and the remainder in miscellaneous truck crops.

Variations in the yield of the four leading truck crops were as follows: Tomatoes 254 baskets in 1915 to 397 baskets in 1916, sweet potatoes 184 baskets in 1916 to 260 baskets in 1915, white potatoes 163 baskets in 1914 to 188 baskets in 1916, and asparagus 57 crates in 1914 to 65 crates in 1915.

The total annual farm receipts varied from \$2,300 on small farms to over \$4,000 on the largest farms. The crop receipts represented 86.3 per cent of the income and the live-stock receipts 10.6. The expense for labor was 35.1 per cent of the total expense. Other items were 11.1 per cent for manure, 13.7 per cent for fertilizers, 9 per cent for baskets and crates, and 9.1 per cent for food. The average real estate investment was \$7,850, the operating capital amounting to \$2,595. The average estimated price of land with buildings in 1914 was \$97 per acre. On farms where the crop yields were 29 per cent above the average in the region, the average labor income was \$1,655. Where crop yields were 23 per cent below the average, the labor income was \$528. The average labor income for all farms was \$904 for 1914, \$443 for 1915, and \$1,692 for 1916, or a decrease of 56 per cent in 1915 and an increase of 67 per cent in 1916 from the 3-year average. The value of what the farm contributed toward the family living amounted to \$276 per family averaging about five persons.

Data are presented in 26 tables with several illustrative charts and graphs and maps of cropping systems.

Investigations with regard to profits from agriculture in 1918 and 1919, E. LAUB ET AL. (*Ann. Agr. Suisse*, 22 (1921), No. 5, pp. 249-307).—In summarizing these notes continuing reports on investigations previously noted (E. S. R., 42, p. 688), it is said that the various factors influencing profits from agricultural enterprises for Switzerland all contributed toward making the year 1918 a record one. In 1919 the diminution set in, many branches showing decreases in yields simultaneously with increased costs of production. Two-thirds of the 43.7 per cent reduction in returns over those of 1918 is attributed to operating expenses, including labor, and one-third to reductions in yields.

Report on the offices of agricultural accounting: Results of an inquiry into the organization and function of institutions of agricultural book-keeping in the various countries, F. BILBAO (*Inst. Internatl. Agr. [Rome]. Com. Perm., Proc. Verb.* 1920, pp. 402-411).—A preliminary report is made here on information gained thus far as a result of a special inquiry begun by the International Institute of Agriculture in April, 1913. Brief notes are submitted on the institutions and societies for agricultural accounting in Germany, Austria, Denmark, Great Britain, United States, Hungary, Norway, and Sweden. The method followed by the Swiss Peasants' Union is set forth in detail.

Annual report of proceedings under the Small Holdings and Allotments Acts, 1908 to 1919, for the year 1920.—II, Allotments, L. WEAVER (*Min. Agr. and Fisheries [London], Ann. Rpt. Proc. Small Hold. and Allot. Acts [etc.]*, 1920, pt. 2, pp. V+[41]).—Returns furnished by various authorities are presented in this report showing finally that the total number of allotment holders in England and Wales, December 31, 1920, was about 1,330,000.

Land customs and tenure in Singa district, J. G. MATTHEW (*Sudan Notes and Rec.*, 4 (1921), No. 1, pp. 1-19).—A large number of claims to ownership of

land in the Sudan are said to be based upon hereditary descent from members of the reigning house, vassal chiefs, and holy men, and on titles derived from one of these who had the right of disposing of portions of his own lands. These and claims based on titles given by the Government and others are described. Proofs of claims to ownership and the system of inheritance are briefly outlined.

Agricultural and commercial loans, J. B. McDUGAL (*Ann. Amer. Acad. Polit. and Soc. Sci.*, 99 (1922), No. 188, pp. 199-203, fig. 1).—A tabulation is given of loans to all member banks in a preeminently agricultural State compared with loans to the largest borrowing bank in the Seventh Federal Reserve District and loans to all member banks in the city of Chicago, including percentages showing the ratio of amounts borrowed to reserve deposits kept in the Federal Reserve Bank. The figures are given at intervals of three months beginning July 2, 1920, and including October 1, 1921, the period of greatest expansion of credit in the United States.

The total borrowings for all member banks in the agricultural States were on one date nearly five times their total reserve deposits, while those of the largest borrowing bank in the Federal Reserve District at the peak were about two and one-half times its reserve deposit. On October 1, 1921, the largest borrowing bank in the Federal Reserve District was indebted to the Federal Reserve Bank to the extent of 22 per cent of its reserve deposit, while the total borrowings for all member banks in the State were 344 per cent of their total reserve deposits.

Furthermore, a chart, showing the percentage comparison of loans by the Chicago Reserve Bank to all member banks in a certain agricultural State with those to the largest member bank in the district and to all member banks in Chicago, shows that since April 2, 1921, there has been a great decrease in the amounts owed by the city banks, whereas the curve for the agricultural State does not show a proportionate decline.

Comments on the Federal law pertaining to agricultural credit, R. GANDÍA CORDOVA (*Rev. Agr. Puerto Rico*, 7 (1921), No. 5, pp. 5-32).—These notes are descriptive of the rural-credit system established in Porto Rico under a Federal law providing for regional banks and national farm loan associations. Duties of officers and agents are outlined, and details of administration are set forth.

The practical rôle of agricultural credit, L. MALPEAUX (*Vie Agr. et Rurale*, 10 (1921), No. 44, pp. 293-296).—A brief historical résumé is given of legislation providing for organized rural credit and of the working of the system as developed in France up to and including 1920.

Rules for a sheep stock club cooperative credit society, with shares and limited liability (*London: Scot. Bd. Agr.*, 1921, pp. 20).—Rules are prescribed for the organization of societies combining the credit of their members, so that loans may be made to them for the purpose of taking over and managing the sheep stock under regulations of the Board of Agriculture and the Scottish Land Court.

Insurance in agriculture in Argentina, D. BÓREA (*Bol. Min. Agr. [Argentina]*, 26 (1921), No. 2, pp. 216-249).—Various types of insurance necessary in promoting agricultural industries are described, with examples of each and notes on its development in Argentina. A forecast of future development is said to involve the necessity of exact information as to risks incurred in agriculture.

A proposed tax on unimproved land values, S. H. PATTERSON (*Ann. Amer. Acad. Polit. and Soc. Sci.*, 95 (1921), No. 184, pp. 188-193).—The Ralston-Nolan

bill proposing a tax of one per cent upon all land values in excess of \$10,000 affords an opportunity for this discussion of the incidence of such a tax upon economic rent of land and natural resources, agricultural or other, and for emphasizing the need of further study to avoid the shifting of taxes. This bill is said to place a burden upon the large holder which can not be shifted by the owner to the renter or to the consumer in the form of higher prices for food or other products from the land. It is said to promise social benefits in so far as speculation in land would be discouraged and idle land brought under cultivation.

The valuation of rural property, E. A. CONI (*Rev. Econ. Argentina*, 6 (1921), No. 36, pp. 425-447).—This is a discussion of general considerations regarding land values from the point of view of location, rainfall, water supply, soil, native vegetation, possibilities of irrigation or drainage, and other factors. Different bases for valuation, such as crop yields, purchase and sale price, and assessed value as security are set forth. A study is made of yields of wheat and costs of wheat production in Argentina through a number of years, and applying a given formula a valuation presumably applicable to wheat land is arrived at, which is, however, very low. The author urges painstaking studies by seminar students in rural economics for the purpose of obtaining a reliable census of production year by year and region by region which might furnish a basis for the valuation of agricultural land.

[Wages in] agriculture, A. L. BOWLEY (*In Prices and Wages in the United Kingdom, 1914-1920. Oxford, Eng.: Clarendon Press; New York: Humphrey Milford, 1921, pp. 169-176*).—This chapter, from a volume of the Economic and Social History of the World War (British Series), edited by J. T. Shotwell, offers a brief analysis of wages and earnings of agricultural laborers in England, Wales, and Scotland in 1907, indicating average increases from 1914 to 1920. A detailed statement is made for all counties in England and Wales, 1914 and 1917-1920, showing rates of wages of ordinary agricultural laborers.

Marketing agricultural products, B. H. HIBBARD (*New York and London: D. Appleton & Co., 1921 pp. XV+389*).—Part 1 of this discussion for college students and persons directly concerned with the actual operations of selling farm products sets forth the principles underlying marketing processes. Types, methods, and agencies are distinguished. The main services of the middlemen are described. One significant observation is made that the claim that there are too many middlemen and the suggested remedy resolves itself into a proposal to put new middlemen into the places of old. It is pointed out that the expansion of a cooperative company involved in successful integration of marketing often really means the assumption of the middleman service involving investment of capital and employment of labor. It is said that the middleman operations are services which must be performed economically and well, and that scientific information must precede reform, likewise a workable knowledge of the business involved should precede the assumption of it on the part of the reformers.

In the discussion of freight rates as a factor in marketing and prices of farm products, the mutual advantage of adequate transportation at the lowest cost is emphasized.

The desirability and practicability of grades and standards, the importance of assembling and storing, as well as problems of financing market transactions are dwelt upon. Chapters are devoted, respectively, to the history and function of exchanges, terms used and methods of operation, indictment of future trading, and its defense.

Several methods of price determination are discussed. It is said that arbitration boards will be necessary if we are to have fair prices in place of competi-

tive. The author holds, however, that in the case of farm products the predominating force is competition, and that in a modified form this is likely to hold first place indefinitely.

He discusses historically the agitations at various times of the question of an agricultural tariff, as well as the proven effects of protection on wool, sugar, wheat, meat, and corn. It is said that "wages in industry and the prices of farm produce are out of balance. Something more fundamental than the passage of a tariff act covering the question of an import tax on wheat, meat, and butter will have to take place before the balance is restored, and when it is restored the foreign market for American agricultural products will be a vital consideration in farm economy."

Parts 2 and 3 are devoted, respectively, to reforms through general organizations and politics and reforms through cooperative business organizations. These are descriptive, sketching briefly the history of such organizations and the main issues on their programs.

A brief list of references is included at the end of each chapter.

Marketing methods and policies, P. D. CONVERSE (*New York: Prentice-Hall, Inc., 1921, pp. XX+650, figs. 10*).—Marketing functions and physical marketing facilities, principally means of transportation and storage, trade channels, brokers and sales agents, wholesale dealers, auction sales, organized produce exchanges, and the question of speculation are treated mainly from the viewpoint of marketing farm products. The author sets down a chronicle of attempts by the Grange and by various farmers' movements in the field of cooperative marketing, as well as the organization for commodity marketing among growers themselves. The discussion of retail types and methods, trade associations, market analysis, and choice of methods of distribution, as through selling through a sales company, sales agent, or broker to the wholesaler, the retailer, or the jobber, or to the consumer direct, applies in the main to factory products. It is said that not only must the trend of prices be taken into consideration in setting a price but that other factors, such as the cost of producing, competitors' prices, the quality and the reputation of the product, the customary price, and what consumers will pay without a serious falling off in demand, must be held in mind. Various price policies are set forth.

Efficient marketing, T. MACKLIN (*Hoard's Dairyman*, 62 (1921), No. 24, pp. 704, 705, 712, figs. 6).—This is a discussion of efficient methods of marketing butter in which comparison is made of practices followed in parts of Wisconsin, Minnesota, and Iowa, where butter is produced by local creameries; in Kansas, where it is manufactured by centralizers and marketed under what is known as the integrated method; and in New Zealand, where the manufacture is in the hands of cooperative federated centralizers. An analysis of costs of operating shows a saving of 2 cts. a pound as a result of integrated marketing. The author recommends either consolidation of local plants into fewer centralizers or organization of local units into federated systems. Graphic illustrations are presented of the production and consumption of condensed milk, butter, and cheese by months.

Price determination and cooperative marketing, J. E. BOYLE (*Cornell Countryman*, 19 (1922), No. 4, pp. 106, 107).—This is a brief discussion of the significance of the farmers' attitude toward price determination through cooperative associations, advocating that it be to encourage collective bargaining representing the interests of producer, distributor, and consumer alike. The author suggests further that farmers' organizations must be concerned with the quality and service in the product marketed, just as trade federations are said to be.

Organizing and operating cooperative live-stock shipping associations. E. G. NOURSE and F. ROBOTKA (*Iowa Agr. Col. Ext. Bul.* 85 (1921), pp. 16, fig. 1).—Directions are offered and a model form is given for drawing up articles of incorporation under the Iowa cooperative law.

The southern farmer tries cooperative marketing. S. D. FRISSELL (*Amer. Rev. of Reviews*, 65 (1922), No. 1, pp. 59-63, figs. 4).—The story is told of the organization of a tobacco marketing association in Virginia and the Carolinas.

Farmers' Market Bulletin (*North Carolina Sta., Farmers' Market Bul.*, 9 (1922), No. 47, pp. 8).—This gives the partial list of products which farmers have for sale, including also a note in regard to the work of a specialist in live-stock marketing in developing a market for surplus crops through farmers' cooperative organizations.

Milpa agriculture, a primitive tropical system. O. F. COOK (*Smithson. Inst. Ann. Rpt.* 1919, pp. 307-326, pls. 15).—The system of agriculture described in this paper is that characterized by the planting of crops in temporary clearings in the tropical forests. A minimum of labor and equipment is required, since the clearing is accomplished by cutting and burning. No cultivation is given to the crop during the growing period. With successive plantings in such a clearing, the growth of grasses is encouraged, and this finally makes necessary a new clearing. It is at best the agriculture of a nomadic stage of civilization, and population is limited by the limited production of food.

The business man and our agricultural problem. H. C. WALLACE (*Current Affairs*, 12 (1922), No. 34, pp. 3, 4, 27, 31, 32).—In this address before the Boston Chamber of Commerce it is pointed out that the purchasing power of major farm products is lower than at any time in United States history. Congressional action intended to relieve the stringency prevailing for the agricultural population, or about 40 per cent of the total, is classified as (1) improvement of credit facilities; (2) permissive legislation which will encourage the farmer himself to improve methods of marketing farm crops; and (3) assurance of free, open, and competitive markets under reasonable Government supervision over marketing agencies. Suggestions are made regarding a number of requirements by the agricultural industry in the way of credit machinery, improvement of marketing methods and reduction of marketing costs, cheaper transportation, adequate market information including studies of foreign demands, and research along lines of conservation of soil fertility.

The Agriculture Act, 1920. I. CONNELL (*Highland and Agr. Soc. Scot. Trans.*, 5. ser., 33 (1921), pp. 21-42).—The leading provisions of the act, consisting mainly of amendments to the Corn Production Act, 1917, are explained.

The policy of the Agriculture Act. C. DOUGLAS (*Highland and Agr. Soc. Scot. Trans.*, 5. ser., 33 (1921), pp. 1-20).—This article preserves a record of the policy adopted in Great Britain as a result of the experiences of the war in an attempt to stimulate home food production.

The new tariff duties (*Bul. Agr. [Milan]*, 55 (1921), Nos. 31, p. [1]; 32, pp. [1, 2]).—The tariff put into effect in Italy July 1, 1921, is briefly discussed, and the schedule for agricultural products is given.

The development of institutions under irrigation. G. THOMAS (*New York: Macmillan Co.*, 1920, pp. [XI]+293, pls. 2).—This treatise is concerned with the development of the institutional use of water and other phases of communal life as dependent upon irrigation agriculture. Many concrete examples are taken from early regulations and agreements resulting from conditions in Utah, from State laws and certain lawsuits, and other legal complications arising out of the use of irrigation water in this region. The Bear River Canal is described in detail as the first large commercial irrigation scheme in the West and illustrating the difficulties resulting from lack of State or Federal

control. The history of State and Federal irrigation projects and State assistance of private projects is then reviewed.

Rural reconstruction, H. W. WOLFF (*London: Selwyn & Blount, Ltd., 1921, pp. [5]+363*).—Much information covering agencies and methods of rural organization and improvement in country life in France, Belgium, the Netherlands, Italy, Russia, and Japan, but more specifically in Canada and in the United States, is included in this comprehensive survey. Particular stress is laid upon the importance of agricultural education as the most vital issue on the program looking toward rural reconstruction. Secondary emphasis may be said to be upon cooperative organizations providing credit for agricultural production and upon profit sharing in agriculture.

Locating the rural community, D. SANDERSON (*Cornell Reading Course for the Farm, No. 158 (1920), pp. 415-436, figs. 8*).—As this author defines it, a rural community consists of the people in a local area tributary to the center of their common interests. Directions are given for mapping a community and determining the boundaries of the trade areas, church areas, or school areas, respectively, of which it may be composed. Examples of unusual communities in which the center of interest is shifting and of complex communities possessing several distinct centers drawing upon a common territory are described and mapped. The fact that many institutions are now attempting to organize their work on a community basis is pointed to as indicative of the significance of the community in social organization. The clock-system rural index is briefly described.

A high school social center, history and description of the social and recreation work of the La Salle-Peru Township High School, J. W. MARRE (*La Salle, Ill., 1921, pp. 46, figs. 21*).—This school and community center, started as a private philanthropic project, is briefly described.

The General Statistical Service and its program, U. RICCI (*Inst. Internatl. Agr. [Rome], Com. Perm., Proc. Verb. 1920, pp. 586-692*).—This gives a report on the organization of the statistical reporting service of the International Institute of Agriculture, its statistical publications, and plans for their enlargement and improvement.

Monthly Crop Reporter (*U. S. Dept. Agr., Mo. Crop Rptr., 7 (1921), No. 12, pp. 145-164*).—This, the final issue of this publication, is devoted principally to crop statistics for the years 1919, 1920, and 1921 by States of specified crops comparing acreage, yield per acre, production, price December 1, and total farm value and value per acre on the basis of the December 1 price. Numerous other tabulated reports on acreage, condition, and prices are made. Wages of male farm labor in 1910, 1920, and 1921 are tabulated by States. Estimated farm value of important products and average prices received by producers of the United States are reported as usual.

Weather, Crops, and Markets (*U. S. Dept. Agr., Weather, Crops, and Markets, 1 (1922), Nos. 1, pp. 1-16, figs. 2; 2, pp. 17-48, figs. 9; 3, pp. 49-64, figs. 3; 4, pp. 65-88, figs. 2*).—This is a new publication combining the *Market Reporter*, the *National Weather and Crop Bulletin*, and the *Monthly Crop Reporter* hitherto issued separately. A review of weather conditions of the week presented in each number, weekly and monthly reviews and statistical information relative to the principal markets for farm products, and detailed reports of the crop estimating service form the greater part of the material published.* Statistical and economic articles on particular commodities or outstanding market situations are included in each number.

No. 2 contains the usual information as to acreage and estimated production of various crops, farm value of important products, and average of prices received by producers of the United States as noted above for an earlier period.

The same number contains also annual live stock and meat trade reviews. Reports on weather conditions are noted elsewhere.

Report on agriculture in the Netherlands in 1920, P. VAN HOEK (*Dept. Landb., Nijv. en Handel [Netherlands], Verslag. en Meded. Dir. Landb., No. 3 (1921), pp. LI+114, fig. 1*).—This report, with detailed statistical tables, contains information previously noted (*E. S. R., 42, p. 191*).

AGRICULTURAL EDUCATION.

[**Agricultural education in Scotland, 1920**] (*Scot. Bd. Agr. Rpt., 9 (1920), pp. XXX-XXXVII*).—A growth in numbers attending the higher courses of instruction, particularly the agricultural colleges, is noted throughout the country. Courses offered and numbers of students in attendance, scope of extension work, and training in agriculture and allied occupations provided for ex-service men are reported.

Agricultural education, E. J. MACMILLAN (*Union So. Africa Dept. Agr. Jour., 4 (1922), No. 1, pp. 21-25*).—This review of the activities of the Department of Agriculture for the Union of South Africa along the line of agricultural education in 1920-21 covers the teaching staff employed, courses of instruction and attendance at the schools of agriculture, training for returned soldiers, and extension work.

Learning by the Smith-Hughes method (*Iowa Agr., 22 (1921), No. 9, pp. 253-255*).—Federal and State funds available for vocational education in Iowa in 1921-22 are set forth. Legislation providing instruction in agriculture and home economics is briefly noted, as well as teachers' training and vocational agricultural and home economics courses offered.

Statistics of cooperative extension work, 1921-22, E. MERRITT (*U. S. Dept. Agr., Dept. Circ. 203 (1922), pp. 18*).—A summary is given of statistics relating to sources, amounts, and project allotment of funds used and number and distribution of persons employed in cooperative extension work in agriculture and home economics, compiled from the approved budget statements in which the State agricultural colleges have outlined their plan of work for 1921-22.

Home economics extension service in Illinois, J. L. BANE (*Illinois Sta. Circ. 248 (1921), pp. 3-18, pl. 1*).—The scope of the field of home economics education is outlined, and the organization of the home economics extension service, including that of the home bureau, is described. The organization of the latter is composed of the executive board, the advisory council, and county and community committees, each county home bureau employing a woman trained in home economics as an adviser in carrying out its program of work. A suggestive outline of such a program is given. Methods in extension teaching are said to correspond to those where each individual of a group shares with the others the benefits of her knowledge and experience. The project method is being applied to extension teaching, home projects being commonly designated in this work as home demonstrations.

Household arts for junior high schools, D. SNEDDEN (*Jour. Home Econ., 13 (1921), No. 7, pp. 289-296*).—Four social case groups suggested as making up the girls' student body of any typical American junior high school are analyzed, and suggestions are made as to household arts and related courses which it is considered might theoretically be feasible for such a school to offer to appeal to each of the groups.

Working directions in sewing, L. GRIFFIN (*Ark. Agr. Col. Ext. Circs. 118 (1921), pp. 9, figs. 5; 119 (1921), pp. 11, figs. 8; 120 (1921), pp. 6, fig. 1; 121 (1921), pp. 4*).—These four circulars contain working directions for making

certain articles and garments required in each year of a four-year girls' home demonstration club course in sewing.

Relation of boys' and girls' club work to the rural home and community, G. WARREN (*Jour. Home Econ.*, 13 (1921), No. 5, pp. 207-212).—It is intended to show briefly how the work provided in homemaking and agricultural clubs gives rural boys and girls such experience as they can capitalize in their future work as farmers and homemakers.

Poultry keeping for boys and girls, W. G. KRUM (*N. Y. Agr. Col. Junior Ext. Bul.* 9 (1921), pp. 16, figs. 9).—Instructions for poultry project workers are included in this leaflet.

MISCELLANEOUS.

Annual Reports of the Department of Agriculture, 1920 (*U. S. Dept. Agr. Rpts.* 1920, pp. VIII+675).—This contains the reports of the Secretary and heads of bureaus and other administrative officers. The various reports are also issued as separates.

Work and expenditures of the agricultural experiment stations, 1919, E. W. ALLEN, E. R. FLINT, and J. I. SCHULTE (*U. S. Dept. Agr. [Rpt.] Work and Expenditures Agr. Expt. Stas.*, 1919, pp. 94).—This report consists mainly of a discussion of the activities of the stations and the use made by them of the funds granted by the Federal Government under the Hatch and Adams Acts, including the usual detailed statistics compiled from official sources as to the organization, revenues, additions to equipment, and expenditures of the stations.

The total income of the experiment stations for the fiscal year ended June 30, 1919, was \$7,192,912.41, comprising \$715,287.99 derived under the Hatch Act, \$710,125.93 under the Adams Act, \$190,000 from Federal appropriations for the insular stations, \$2,734,089.20 from State appropriations, \$398,795.01 from fees, \$1,439,817.92 from the sale of products, \$491,551.75 from miscellaneous sources, and \$688,658.53 carried over as balances from the previous year.

The estimated value of additions to the equipment of the stations during the year was \$960,827.76, of which \$433,694.26 was for buildings.

In the work of administration and inquiry the stations employed 1,881 persons, of which 944 were also members of the teaching staff of the colleges, and 410 assisted in the various lines of extension work. During the year the stations published 1,285 annual reports, bulletins, and circulars, aggregating 25,046 pages, and these were distributed to 959,068 addresses on the regular mailing list.

Report of the director for 1921, E. H. JENKINS (*Connecticut State Sta. Bul.* 232 (1921), pp. 18).—This report briefly summarizes the work of the station during the year ended October 31, 1921.

Annual Report of New Jersey Stations, 1920, J. G. LIPMAN ET AL. (*New Jersey Stas. Rpt.* 1920, pp. XXXII+610, pls. 23, figs. 63).—This contains the organization list, a financial statement for the fiscal year ended June 30, 1920, a report of the director on the work and publications of the year, and departmental reports, the experimental features of which, not previously reported, are for the most part abstracted elsewhere in this issue. An extensive report of the division of extension in agriculture and home economics, containing considerable data pertaining to demonstration work, is also included (pp. 161-247).

Quarterly Bulletin of the Michigan Experiment Station, edited by R. S. SHAW and E. B. HILL (*Michigan Sta. Quart. Bul.*, 4 (1921), No. 2, pp. 33-66, figs. 11).—In addition to articles abstracted elsewhere in this issue, this number contains the following: More Alfalfa, by J. F. Cox; The Opportune Time to Sell Cash Crops, by H. B. Killough; Fall and Winter Care of Pullets, by W. E. Newlon; and Wood in Silo Construction, by G. A. Garratt.

NOTES.

California University and Station.—In accordance with an act of the last legislature, a commission of agricultural education has been appointed by the governor to formulate the needs of agricultural teaching and research in California and report to the next legislature. This commission consists of A. C. Hardison, who succeeds the late G. Harold Powell, G. H. Hecke, H. A. Jastro, Senator S. C. Evans, Mark Grimes, R. N. Wilson, and Dr. Elwood Mead.

Charles S. Bisson has been appointed professor of chemistry at the Davis branch of the College of Agriculture.

Fellowships of the Crop Protection Institute.—The Crop Protection Institute of the National Research Council is planning to offer two fellowships of \$2,500 each, in order to promote original research relative to the fungicidal and insecticidal properties of sulphur and the effects of sunlight, temperature, and moisture on its action. Training in chemistry and plant physiology is a prerequisite, and candidates should have demonstrated ability to undertake research projects of a high type.

Agricultural Education in Canada.—Construction is under way for the memorial hall of the Ontario Agricultural College. This will be an auditorium building of Guelph limestone, capable of seating 1,200 persons and costing about \$100,000.

The Honorary Advisory Council for Scientific and Industrial Research of Canada has made a grant to the department of chemistry of Macdonald College for an investigation of soil acidity. The various methods proposed for the measurement of soil acidity will be compared, surveys in Quebec will be carried on, and the relation of acidity to crop growth will be studied with a view to deciding whether full or partial correction of acidity should be attempted in soils devoted to specific crops or crop rotations.

Brazilian Division of Meteorology.—The work of the Brazilian Division of Meteorology and Astronomy has been divided, the meteorological work being organized as a separate division under the direction of Dr. Sampaio Ferraz. This division will continue the climatological work begun in 1909, establishing a forecast service for central and southern Brazil, an agricultural meteorological service, and a special service of rains and floods, and will carry on numerous other investigations and undertakings.

Necrology.—Giacomo Luigi Ciamician, senator of the Kingdom of Italy and professor of the University of Bologna, died January 2. Professor Ciamician was widely known for his studies in many departments of science, but especially in plant chemistry in which he made important contributions to our knowledge of the nature and constitution of substances produced by photosynthetic processes in the vegetable organism. *Nature* summarizes his work in this field as follows:

"In conjunction with Ravenna, Ciamician studied the effect of the introduction of various natural organic products into plants, with the view of determining their fate, or their influence on the life history or development of the plant. They showed that plants will tolerate and utilize glucosids, such as

amygdalin, salicin, and arbutin, but will quickly die when the aromatic constituents of these glucosids are separately introduced. They found that plants are capable of transforming saligenin, benzyl alcohol, and vanillin into glucosids, saligenin, for example, being converted to salicin. They studied the effect of the inoculation of pyridin, piperidin, and pyrrol derivatives on the formation of alkaloids; they found that the amount of nicotin in the tobacco plant could be considerably increased by the introduction of dextrose. Their results lent support to the view that vegetable alkaloids have their origin in amino acids, and that bases, such as lysin and ornithin, formed from amino acids, are utilized by plants in the synthesis of alkaloids."

New Journals.—*Revue de Botanique Appliquée et d'Agriculture Coloniale* is being published quarterly by the Laboratory of Colonial Agronomy in Paris. It is expected to confine the journal to original articles dealing with tropical agriculture, colonial horticulture, phytopathology, and colonial forests and woods. The initial number consists mainly of an account of the organization and work of the laboratory since the end of the war, an article dealing with camphor-producing trees, and a note on a disease of agave.

Poultry Science is being published semimonthly by the American Association of Instructors and Investigators in Poultry Husbandry, replacing the *Journal of the American Association of Instructors and Investigators*. The first number contains articles on The Differential Diagnosis of Diseases of the Head of Fowls, by J. R. Beach; Body Temperature of Newly Hatched Chicks, by L. E. Card; and Comparative Study of the Body Temperature of the Different Species and Some Representative Breeds of Poultry.—A Preliminary report, by F. M. Fronda, together with the report of the secretary treasurer for 1921, minutes of the annual meeting, etc.

Acta Zoologica, described as an international organ for all branches of zoological science except purely those descriptive and systematic, is a quarterly journal issued at Stockholm with Nils Holmgren as editor and an international board on which are about 11 representatives from the United States. It is expected to give special attention to morphology, histology, embryology, paleontology, physiology, and experimental and general zoology.

Bollettino della Società Italiana per lo Studio della Alimentazione is being issued for the presentation of original articles and abstracts on food and nutrition. The initial number contains articles dealing with the nutrition of nursing infants, a study of the composition of the maize kernel, and experiments in the preservation of eggs.

Boletim de Agricultura is a quarterly, published by the Agricultural and Forestry Service of Portuguese India. The initial number contains a discussion of agricultural problems in the region, and numerous short articles by members of the staff.

The Department of Agriculture and Industry of Salvador has established *Revista de Agricultura Tropical* as its official organ. The initial number contains an original article on Jaragua Zran (*Cympogon rufus*), several shorter articles, reprinted matter, etc.

The Biologische Reichsanstalt für Land u. Fortwirthschaft, Berlin, Dahlem, has begun the publication of *Nachrichtenblatt für den deutschen Pflanzenschutzdienst* as a monthly bulletin of information for the plant protection service.

Notulae Entomologicae is being published quarterly by the Entomological Club of Helsingfors, Finland. The initial number contains several original articles, abstracts, necrological notes, etc.

EXPERIMENT STATION RECORD.

VOL. 46

MAY, 1922.

No. 7.

The conception of the field and content of the subject of agriculture has steadily unfolded and expanded. As now understood it relates not merely to the industry of production but to the business side; and it includes not merely a means of livelihood but a method and condition of living. For economics is seen to have a very fundamental place in determining the course and the adequacy of agricultural production, and the farm home constitutes an integral part of the farm enterprise. If there is to be full rural progress its problems can no more be ignored than the difficulties which beset the farm crops or the pests that menace the farm live stock.

These propositions are generally acknowledged, yet it has sometimes appeared as if organized efforts to aid the farmer's wife had lagged behind those for the benefit of the farmer himself, just as frequently all sorts of outdoor improvements have preceded the renovation of the farm kitchen. In particular, the impression seems to be somewhat widespread that the agricultural experiment stations have busied themselves almost exclusively with problems outside the home. Doubtless this is measurably true, and with limited funds and other handicaps it is not surprising that attention has been concentrated primarily upon the problems of production. At the same time the fact remains that considerable has been accomplished and much is at present under way of direct interest to the farm household and to home economics workers.

The extent of this activity is not always realized. In part it is a direct effort, the stations deliberately entering the field of home economics, and in part it is more or less incidental to other work. It has come about quite naturally from the fact that the problems of agriculture and home economics are often allied, that the basic principles of human and animal nutrition are essentially alike, that discoveries along several other lines of agricultural inquiry may have an important bearing on home economics, and that above all, home economics involves the utilization of agricultural products.

Station work on lines related to food and human nutrition has been, in fact, well-nigh contemporaneous with the stations themselves. It will be recalled that the first director of the Office of Ex-

periment Stations, Prof. W. O. Atwater, was conspicuous for his pioneer studies in the field of human nutrition. Largely through his efforts the stations were specifically authorized in 1894 to include the study of the food of man in their inquiries, and a small appropriation was made to enable the department to cooperate with the stations in investigations on the nutritive value of the various articles and commodities used for human food. The prosecution of this inquiry was assigned to this Office, and active cooperation was begun with several stations as well as with other institutions. This cooperation continued in some cases for many years, and one ultimate outcome was the development of the well known activities of the Office of Home Economics.

Another early point of contact of the stations was through control work on foods and dairy products. In several States the analytical and in others the entire regulatory activities were entrusted to the stations, and in a number this is still an important branch of their organization.

Of recent years the interest of the stations in this subject has been more active, although funds have not always been available to enter upon it. Still, the current classified list of projects carried on by the stations contains 64 projects under the specific heading of Foods and Human Nutrition. No less than 24 of the stations, or practically half of them, are represented in this list. These projects are subdivided under food preservation, milling and baking, storage, and miscellaneous studies; and in addition 75 others may be noted as having an important bearing on, or possible application to, some phase of home economics work.

Historically, attention to this subject began with food and nutrition. Largely the work of the stations has held to that field, because here the problems were more definite and they most frequently crossed the lines of other station work. But the scope of such nutrition work has greatly broadened, taken up in part for itself and in part due to the fact that the principles and facts developed often relate to the human as well as the strictly agricultural side. In other branches of home economics the research features are as yet not so definitely defined.

The data on the composition of materials used for human food will be recognized as having come in very large proportion from the laboratories of the experiment stations and this Department. Special studies have shown the value of these materials in human nutrition, and their suitability or unsuitability to meet physiological needs. This is true of such standard products as wheat, in relation to which the former view of constituting a complete food has been reversed by many experiments with various kinds of animals. The dietetic value of green vegetables has been explained, and considerable at-

tention has been given to the composition and qualities of meats as influenced by feed and other factors of production.

It is only necessary to recall the large amount of study upon dairy products to understand this dual relationship and the extent to which the station investigations have been fundamental to human nutrition. The whole subject of milk supply, not only its production, quality and the factors which affect its composition, but its purity, detection of adulteration and additions or treatment, its cleanliness, wholesomeness, sources of contamination, dangers to health, and many other points, constitutes a very large chapter in the work of the stations extending almost from their beginning. The same is true of various other dairy products.

The essential qualities of cereals for human use, the conditions of production which influence the suitability of flour to different purposes, and factors involved in bread making have long been the subject of extensive investigation.

During the war several stations studied the economy of the more staple foods and made specific recommendations for substitutes, while others developed methods for using certain of the non-saccharin sorghums or for the preparation of special food products. For example, as a result of its studies the Washington Station devised a process for the preparation of gluten retaining its normal qualities, for mixing with flour or making gluten bread, which it patented and dedicated to public use.

While these studies were not necessarily made from the primary standpoint of home economics, they have contributed in no small measure to the fund of scientific and practical knowledge in that field. On the other hand, the energy determinations of foods by the bomb calorimeter, digestion experiments, dietary studies, and the more recent studies on vitamins, have had a most direct relationship and have been prosecuted with that end quite largely in view.

The latter have come to form a quite conspicuous feature of the station work, and historically the stations have had a leading part in developing the modern vitamin conception. It was foreshadowed by the work of Osborne and Mendel on the chemistry of plant proteins, started essentially as a problem in animal nutrition, from which came as a direct outcome a realization that in addition to the carbohydrate, proteins, fats, salts and water hitherto deemed sufficient to supply all nutritive needs, at least two other "determinants" are necessary for successful nutrition. While this work was going on, similar conclusions were being reached from a slightly different angle of approach at the Wisconsin Station.

The work thus begun a decade ago has gone steadily on, and much of our present knowledge of vitamins can be traced directly to these stations. From the Connecticut State Station have come systematic

studies of the distribution of vitamins A and B in plant and animal materials, and of their physical, chemical, and physiological properties. One of the most successful attempts at concentrating and isolating vitamin B has been made at that station in work that is still in progress. The question of the necessity of preformed carbohydrate and fat in the diet has also been made the subject of investigation, and it has been found that rats, when fed rations in which the amount of fat and carbohydrate, respectively, has been reduced to traces only, but with all the other constituents, including vitamins in optimal proportions, have grown to adult size at normal and in some cases more than normal rates. In similar experiments in which both fat and carbohydrate were present in traces only, the diet consisting chiefly of proteins, rats have grown at more than normal rate up to 225 grams weight, but subsequent growth has been much slower, leaving the final outcome uncertain.

From the Wisconsin Station have come studies of the dietary deficiencies of different articles of food, leading to the generalization of the supplementary dietary relationship between leaf and seed as contrasted with seed and seed. At that station the interesting suggestion has been developed of a relationship between yellow pigmentation and the presence of vitamin A. Although this relationship has been questioned by other investigators, further studies at the station have given sufficient instances of apparent correlation between vitamin A and pigmentation to indicate some chemical or biological relationship, the exact nature of which is still unknown.

This theory has aroused the interest of farmers, particularly as affording a plausible explanation of the superior nutritive value of yellow over white corn, and at several stations projects are under way further to test this view in cattle, swine, and poultry feeding. Evidence has already been obtained at the Kansas Station of better egg yield on yellow than on white corn. This has further justified the housewife in her instinctive belief that eggs with deep yellow yolks are "richer" than pale-yolked eggs. Further work along this line may be expected to be of direct value in affecting the choice of food materials in both human and animal nutrition.

The earliest vitamin studies showed the importance of milk as a source of vitamins, and it is perhaps in connection with this most important item of food that the work of the stations has been of the greatest value to human nutrition. With increasing knowledge of the properties of vitamins and of their significance in nutrition, the desirability has become apparent of increasing to the greatest possible extent the vitamin content of milk and of preventing its destruction in the various processes to which milk and its products are subjected. These problems are of interest alike to the producer

and to the consumer. Investigations at the Wisconsin and Minnesota Stations have shown that the feed of the cow is a very large factor in the relative antiscorbutic potency of the milk produced. Summer pasture milk may have three times as much of vitamin C as that produced in winter by cows fed largely on dried grains and hays.

This work has been extended at the Minnesota Station to a study of the influence of the feed of the cow upon the quantity of vitamins A and B in the milk. In a recent report of this investigation the conclusion is drawn that, as in the case of vitamin C, the content of vitamins A and B in cow's milk is entirely dependent upon their occurrence in the ration, but that this does not necessarily imply that access to open pasture always assures a ration rich in vitamins. "Stall-fed cows will produce a milk rich in vitamins provided their ration consists of a proper combination of grains and leafy foods." It is thus seen that fresh cow's milk may be rich or poor in vitamins, depending upon the conditions of feeding, and at a number of stations (Kansas, New York Cornell, and Wisconsin) projects are under way to test the effects of vitamin-deficient rations and of various supplements to these rations on the milk of dairy cattle. Similarly, it may be inferred that human milk may be rich or poor in vitamins, depending upon the diet of the mother. Osborne and Mendel report that human milk is no richer than cow's milk in vitamin B. Unless careful attention is given to insure that the diet of the mother contains the optimum amount of vitamins, it is quite possible for breast milk to be lower in its vitamin content than fresh cow's milk.

The stability of the vitamins in milk under the conditions of pasteurization, and of the preparation of condensed, evaporated, and dried milk has also been made the subject of considerable study at two or three stations, notably Wisconsin and Minnesota. These studies have shown that with the exception of vitamin C, the treatment to which the milk is subjected in the ordinary processes of pasteurization and drying does not destroy the vitamins, and that in the case of vitamin C there need not be extensive destruction if the proper method be employed. Unsweetened canned milk, "evaporated" milk, has been found at the Wisconsin Station to be almost devoid of vitamin C owing to the rigorous heating that has to be employed in the process. It has been reported from the Connecticut Station that rats have been grown from early age to full adult size for more than a year on dried whole milk powder, corn starch and lard, thus indicating no appreciable destruction of vitamins A and B in the drying process. A comparison at the Wisconsin Station of whole and centrifugal skim milk has shown that in the latter the amount of vitamin A is only one-tenth or less of that in whole

milk. This should be taken into consideration in the use of skim milk powder and the so-called filled milk (evaporated skim milk to which vegetable oil has been added) for children.

The advent of dried milk has been of considerable significance in home economics nutrition work, and the stations are solving some of the problems that have arisen in connection with its use. With the realization of the many advantages that may be claimed for it has also come the knowledge of its possible limitations and the necessity of being able to distinguish it in its reconstructed or reconstituted form from fresh milk. An elaborate inquiry into the physical and chemical constants of various forms of reconstituted milk has just been reported from the Minnesota Station, and in connection with this work nutrition studies are being conducted, together with experiments on the factors influencing the keeping qualities of milk powder.

One of the many uses to which milk powder has been found to be adapted is the manufacture of ice cream. The Oklahoma Station has shown that milk powder and condensed milk make a firmer ice cream of superior keeping qualities. Ice cream studies from various points of view are also being conducted at the Missouri, Indiana, New York Cornell, and Vermont Stations.

The question of the keeping qualities of butter has assumed new importance since it has become evident that other changes more serious from the standpoint of nutrition than the development of off-flavor may result from storage. At the Minnesota Station the effect of storage on the content of vitamin A in butter is the subject of one project, and at Connecticut the effect of heating on vitamin A in butter is under investigation. Both projects are of particular interest in human nutrition.

An interesting study of the nutritive value and tolerance by children of milk of different kinds and richness has been underway for some time at the Vermont Station. Young pigs are used as laboratory animals, being taken from the sow when two days old and fed by bottle with cow's milk of different fat content or with condensed milk, milk powder, or evaporated milk. Specimens are slaughtered at the beginning of the experiment and when the weight has doubled, quadrupled, etc. Analyses are made of the blood, internal organs, liver, etc., and the stomach is removed and its capacity determined. Some of the animals are after a time put back with the sow, while others are kept until they can be put on regular feed. In general the animals fed whole or evaporated milk have not made gains equal to those left with the sow. Whole milk has proved superior to evaporated whole milk, but animals started on the evaporated milk and then put on the regular feed have made fine healthy pigs.

The projects above mentioned by no means exhaust the inventory of station work on milk and dairy products which have an application to human nutrition. They are selected rather to emphasize the contribution of the experiment stations to what has been aptly called the newer knowledge of nutrition. Other important phases of this newer knowledge which are receiving attention at the stations are the composition, constitution, and properties of proteins, especially those of ripe seeds and grains, and their relative efficiency in nutrition, the determination and significance of the amino acids resulting from the hydrolysis of the proteins contained in seeds, grains, grasses, feeds, and foods, the acid-base balance in animal nutrition, factors influencing the normal rate of growth of domestic animals and the effects of arrested development, and the mineral metabolism and mineral requirements of animals.

While it would be stretching the point to say that all of these projects have a direct bearing on human nutrition, the connection is closer than might at first seem apparent. As an illustration of this work may be cited the studies of dietary factors influencing calcium assimilation by the dry and lactating goat. On a basal grain ration and salt or on this ration plus oat straw a negative calcium balance was established, while on the same ration supplemented by green oats, both in the fresh and dried state, an increase in calcium retention took place. The administration of cod liver oil likewise changed the negative calcium balance to positive. These observations are of interest to the farmer in affording further evidence of the value of green feed, and to the student in human nutrition in suggesting a clue as to one factor at least responsible for the failure of a calcium retention and the development of rickets.

Turning from the subject of the fundamental requirements of nutrition to the materials with which these requirements are satisfied—foods, a survey of the station projects shows much work along the lines of food production and utilization, and food preservation in the home. The one staple article of food which has received the most attention from the production to the consumption end is wheat. The requirements for bread making are a fundamental consideration for the producer and the housekeeper alike.

At no less than seven stations work is in progress on the composition of wheat with reference to its milling and baking qualities. Exceptional opportunity along these lines is afforded in Minnesota where the State Department of Agriculture has installed an experimental flour mill said to be the most complete in the world, with a member of the station staff serving as director and devoting considerable time to the study of wheat flour grades and the physical

chemistry of bread making. In one of the latter's most recent contributions on the subject, a study of the buffer action of water extracts of flour, he has presented evidence that extracts of high grade flours are buffered less than the extracts of lower grades, and that it consequently requires less acid to bring the H-ion concentration of a high grade or patent flour dough to the optimum for bread production than is required for a low grade flour. He concludes that possibly some of the difficulties experienced in making satisfactory bread from the lower grade flours may be due to failure to obtain the optimum H-ion concentration. This illustrates one of the many instances of the application of the principles of physical chemistry to food preparation.

Another interesting phase of this subject which is beginning to receive the attention of research workers in home economics, and in which there might well be more cooperation between station and home economics workers, is the colloidal chemistry of emulsions. At the Minnesota Station a study is being made of emulsions as illustrated by cream and butter. The former is considered to be an emulsion of the oil and water type, and the latter of the water and oil type. An explanation is being sought for the transformation on churning of one type of emulsion into the opposite type. This suggests the question as to what type of emulsion is being dealt with in making mayonnaise dressing and under what conditions the most perfect emulsion can be formed, and doubtless has application to other practice in cookery.

Canning is a method of food preservation in which application needs to be made of modern scientific principles. The process relates to both keeping quality and freedom from deleterious products. Interest in the development of safe methods of canning fruits and vegetables has been actively aroused as the result of the several outbreaks of botulism from both home and commercially canned products. While the chief work has as yet been done in other than the station laboratories, partly on account of the cost of equipment for such work, a number of stations are engaged in such investigations, among them being Missouri, California, Colorado, Massachusetts, and Iowa. The condensed statement of the Iowa project will show briefly the scope of such work: "To determine the organisms more frequently associated with the deterioration of canned products, the thermal death point of these organisms, the relationship existing between the hydrogen-ion concentration and the thermal death point in order to determine the most favorable composition of all materials for canning."

The Massachusetts Station has an extensive equipment for canning and is studying the effect of continuous, fractional, and pressure

methods of sterilization upon microorganisms, and attempting to determine the medium temperature between that required for sterilization and that which will injure the qualities of the product. The bacteriology of canning is being studied at the Kansas Station. Special studies have been made at the California and Michigan Stations of the thermal death point of *Bacillus botulinus* under various canning conditions. The Illinois Station is engaged in extensive work on various phases of the botulism problem, including methods for differentiating types A and B toxin in foods, the preparation of botulinus antitoxin, the distribution of *B. botulinus* in nature, the occurrence in food materials, and the heat resistance of its spores. In the latter project the home economics department of the university has cooperated in baking tests with food materials artificially inoculated with the organism, to determine resistance to the temperatures attained in cooking.

One form of fruit utilization, the making of jelly, is being put upon a scientific basis requiring the help of many agencies. The problem of successful jelly making depends essentially upon the pectin content of the fruit, and this in turn is influenced by the stage of ripeness of the fruit. Consequently, studies of the factors involved in the ripening of fruits, the chemical composition of fruits during development under varying conditions of treatment, and special studies on the nature and properties of pectins under way at several stations are of direct interest to home economics workers and may be expected to yield results of direct application in jelly making.

The California Station has contributed valuable information on methods of canning and preparing jellies and preserves, on the preservation of fruits by cold storage, and on the dehydration of fruits and vegetables. While these projects have been concerned more particularly with large scale production, many of the principles involved are of direct application to household preservation and utilization of fruits. Similarly many other projects on widely varied subjects may furnish useful contributions to home production of food products. Among these may be cited methods for the preparation of sorghum sirup developed at the Minnesota, Missouri, North Carolina, and Wisconsin Stations, and for sugar beet and apple sirup (Idaho), peach sirup and jam from cull peaches (New Jersey), the utilization of muscadine grapes (South Carolina), and the preparation of vinegar by the use of pure cultures (Iowa, Michigan, and Washington).

Station work outside the field of nutrition is comparatively meager. There are, however, a number of projects dealing with the quality in wool, among them one at the Wyoming Station on the effect of rations containing a high percentage of sulphur upon wool fiber.

In rural engineering, the principal work bearing on this subject deals with the farm water supply, sewage disposal, and sanitation, with a single project on farm structures which includes the farmhouse. Several stations have listed projects on insects infesting stored products, and on insects injurious to human health and comfort.

Economic studies are also not numerous and center quite largely around questions of marketing. Mention may be made of the studies of the retail distribution of food in progress by the Wisconsin Station, the survey of consumer's cooperative associations by the Massachusetts Station, and a study of the balance of trade in food products in two counties of Massachusetts. The Missouri Station has undertaken inquiries as to the cost of the family living on the farm and the standard of farm living as a factor in cost of production. Some of the projects in rural sociology as to the movement of the farm population, rural schools and churches, and rural community life are likewise of much interest from the home economics point of view.

In a considerable degree, therefore, the studies referred to and many other lines of work of the experiment stations are helping to supply the background and contributing to the science of home economics. There is opportunity for enlargement but it is important to take full account of what is being done in making plans for future development. For one thing it may help to clarify the field of actual research and experimentation, as distinguished from teaching and the introduction of better practice. One of the things essential to progress and to preparation for greater research activity is a clear view of the field, some of the leading lines of problems embraced in it, and points of contact with other agencies and fields of inquiry.

Home economics studies, as far as they relate to the nutrition of infants, children, and adults, must reach over into or take account of the manner of production so far as relates to quality, adequacy, suitability. On the other hand, the experiment stations in their legitimate work will inevitably be led over into the home economics side, not alone as a large element in utilization, but through the close relationship of the fields and the similarity of problems. As soon as principles of home economics are involved and fundamental research is entered upon, the association becomes particularly apparent and close, so far as relates to food supply and utilization.

Undoubtedly the home economics outlook will be important in guiding and developing special investigation, as the agricultural outlook has been in focusing inquiry in that field. There would seem to be considerable opportunity also for profitable cooperation in which the home economics department would join with the experi-

ment stations in certain types of agricultural investigation, as for example, in the development or testing of products, their effective utilization or special adaptations. This has been done in a limited way in the past, especially in testing the qualities of experimental products, but the opportunity has probably not been fully utilized.

Recognizing what has been done, the results and methods which have been developed, the need is for supplementing these by other types of research so as to extend and round out the field for home economics inquiry. The chief difference between it and agricultural research lies in the direction it takes, the application of the findings, and the special viewpoint of the home as distinguished from the farm.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

A manual of selected biochemical methods, F. P. UNDERHILL (*New York: John Wiley & Sons, Inc.; London: Chapman & Hall, Ltd., 1921, pp. XIV+232, figs. 12*).—This manual, which is the outgrowth of a course in biochemical methods given at the Yale School of Medicine, consists of a compilation from various sources of general methods of biochemistry and of special standard methods for the analysis of urine, blood, and gastric juice.

Studies of wheat flour grades.—II, Buffer action of water extracts, C. H. BAILEY and A. C. PETERSON (*Jour. Indus. and Engin. Chem.*, 13 (1921), No. 10, pp. 916-918, figs. 2).—In continuation of the studies of wheat flour grades which are being conducted at the Minnesota Experiment Station (E. S. R., 45, p. 615), a study of the buffer action of water extracts of different grades of flour was made with a view to determining definite methods of preparing doughs of any desired H-ion concentration. All H-ion concentration determinations were made electrometrically with the hydrogen electrode described by Bailey (E. S. R., 42, p. 412), connected in the usual way through a calomel electrode to a potentiometer.

It was found that varying the time and temperature of extraction does not appreciably alter the H-ion concentration of the extract. The buffer action of such extracts was increased slightly with an increased time of extraction and considerably by an increase in temperature from 0 to 40° C. The buffer action was reduced but slightly by boiling the extract, thus indicating that the coagulable proteins are not the principal buffers in the extract.

“Since the buffer action parallels the specific conductivity of water extracts and varies with modified conditions of extraction in the same direction and to about the same degree as the activity of phytase varies in hydrolyzing phytin, it appears that phosphates, produced by the hydrolysis of phytin by phytase during extraction with water, may be the principal buffers in the extract.

“Electrometric titration curves show the extracts of high-grade flours to be buffered less than the extracts of lower grades. It consequently requires less acid to bring the H-ion concentration of a high-grade or patent flour dough to the optimum for bread production than is required for a low-grade flour. Possibly some of the difficulties experienced in making satisfactory bread from the lower grade or clear flours may be due to failure to obtain the optimum H-ion concentration of the dough.”

The alkaline hydrolysis of casein, M. A. GRIGGS (*Jour. Indus. and Engin. Chem.*, 13 (1921), No. 11, pp. 1027, 1028, figs. 2).—A study of optimum conditions of time and concentration of alkali for the alkaline hydrolysis of casein is reported, from which the conclusion is drawn that the optimum method is to use 10 per cent sodium hydroxid and to continue the hydrolysis for five hours.

Preparation of mannose from ivory-nut shavings, P. M. HORTON (*Jour. Indus. and Engin. Chem.*, 13 (1921), No. 11, pp. 1040, 1041).—In the method outlined, which has some of the features of the process described by Hudson and Sawyer (E. S. R., 37, p. 201), the ivory-nut powder is first extracted with

1 per cent commercial sodium hydroxid, the washed residue hydrolyzed with cold 75 per cent sulphuric acid, the excess sulphuric acid taken up with slaked lime, and the dissolved nut residue filtered through Norit or some other decolorizing carbon, and then through precipitated chalk. The filtrate is evaporated in vacuo to a light sirup, the sirup poured into an equal volume of 95 per cent alcohol, heated to 90° C., filtered again through Norit, and the filtrate evaporated under high vacuum to an almost solid mass. The mannose is finally crystallized from warm glacial acetic acid.

[**Progress in fat chemistry in 1920**], W. FAHRION (*Chem. Umschau Geb. Fette, Oele, Wachse, u. Harze*, 28 (1921), Nos. 21, pp. 267-271; 22, pp. 281-284; 23, pp. 295-300).—This continues for 1920 the literature review of theoretical (pp. 267-271), analytical (pp. 281-284), and technical (pp. 295-300) fat chemistry (E. S. R., 45, p. 203).

Grape-seed oil, F. RABAK (*Jour. Indus. and Engin. Chem.*, 13 (1921), No. 10, pp. 919-921).—Supplementing the previously noted report (E. S. R., 45, p. 209) on the possibility of the commercial utilization of the waste from grape-juice factories, data are presented from the Bureau of Plant Industry, U. S. D. A., on the physical constants and chemical composition of crude and refined grape-seed oil prepared by pressure and refined by treating with fuller's earth, filtering, and distilling with steam.

The crude oil had a deep yellowish-green color and a nutlike, slightly burnt odor and taste, while the refined oil was of a pale straw color, practically odorless, and of a bland and sweetish taste. The analytical constants of the refined oil were specific gravity at 25° C. 0.9204, index of refraction at 25° 1.472, solidification point -22 to -24°, acid number 0.74, saponification number 192.2, and iodine number 134.1. A comparison of these values with the constants of grape-seed oil reported by foreign investigators showed considerable variation in the oils from different sources. These differences are ascribed to conditions of growth, climate, soil, variety, and methods of extraction. The composition of the grape-seed oil examined is given as follows: Linolein 53.59, olein 35.87, palmitin 5.23, stearin 2.26, and unsaponifiable matter 1.61 per cent.

The preparation and instability of tricalcium arsenate, J. H. REEDY and I. L. HAAG (*Jour. Indus. and Engin. Chem.*, 13 (1921), No. 11, pp. 1038-1040).—With a view to determining the cause of the instability of the insecticide tricalcium arsenate, a study was made of the most favorable conditions for making a stable form of salt. The lime paste-arsenic acid method, as described by Haywood and Smith (E. S. R., 40, p. 10), was considered to be the most suitable process for preparing a high grade product. The most favorable conditions were found to be the use of high temperature and of materials of the highest degree of purity. Thorough mixing is also considered essential, but cooling without agitation has been found to give the best results. The decomposition of tricalcium arsenate is thought to be due to hydrolysis, which is apparently hastened or catalyzed by many substances which may be present as impurities.

Instructions to farmers for the preparation and application of calcium arsenite (*Instrucciones sobre Preparación del Arsenito de Calcio por los Agricultores y su Aplicación*. Buenos Aires: Min. Agr. Nac., 1919, pp. 15, figs. 7).—This bulletin contains brief directions for the preparation and suitable methods of application of calcium arsenite as an insecticide.

Filtration symposium (*Jour. Indus. and Engin. Chem.*, 13 (1921), No. 11, pp. 976-1007, figs. 21).—The following papers were presented at a symposium on filtration at the annual meeting of the American Chemical Society in New York City in September, 1921:

Washing and Washing Ports in Connection with Chamber and Frame Filter Presses, by E. A. Alliot (pp. 976-982); Filter Cloth and Its Relation to Filtration, by A. A. Campbell (pp. 982-984); Industrial Filter Media, by A. Wright (pp. 984-986); Fundamental Laws of Filtration with Suggestions Regarding Research Work, by D. R. Sperry (p. 986); The Feeding of Filters, by J. F. Springer (pp. 986-989); Filter Aids, by C. P. Derleth (pp. 989, 990); The Use of Filter-Cel for Industrial Filtration Processes, by G. M. Hickey (pp. 990-992); Centrifugal Filters, by H. C. Beckman (pp. 992, 993); Discussion of Centrifugal Draining, by T. A. Bryson (pp. 993-996); Pulp or Filter Mass Filters, by E. E. Finch (pp. 996, 997); Leaf and Rotary Suction Filters, by G. D. Dickey (pp. 997-999); Plate and Frame Filter Presses, by E. C. Alford (pp. 1000, 1001); Modern Leaf Type Filters, by R. C. Campbell (pp. 1002-1004); Oliver Continuous Filters, by H. A. Morrison (pp. 1005, 1006); The Atkins-Shriver Automatic Filter Press, by H. D. Atkins (pp. 1006, 1007); and Vallez Rotary Filter, by H. A. Vallez (p. 1007).

Chemical analyses with membrane filters.—H. The quantitative determination of zinc with the use of membrane filters, G. JANDER and H. C. STUHLMANN (*Ztschr. Analyt. Chem.*, 60 (1921), No. 9-10, pp. 289-321).—The results are presented of the determination of zinc by various well-known methods, using, however, in place of ordinary filter paper for the filtrations the membrane filters described in a previous paper (*E. S. R.*, 42, p. 411). The data obtained are thought to give further proof of the superiority of membrane filters over filter paper.

The "thermos" flask in the chemical laboratory, C. W. BOURLET and W. THOMAS (*Chem. News*, 123 (1921), No. 3219, p. 336).—Suggested laboratory uses for the ordinary thermos flask are for carrying on reactions between liquids at elevated temperatures, the separation of emulsions, the separation of colloidal and flocculent precipitates, certain color reactions in which the color is developed only at temperatures above normal, and reactions in media which tend to gelatinize at ordinary temperatures.

Preparation of alcoholic potassium hydroxid volumetric solution, S. T. MCCALLUM (*Jour. Indus. and Engin. Chem.*, 13 (1921), No. 10 p. 943).—A simple method of preparing alcoholic potassium hydroxid solution is described as follows:

"The correct amount of potassium hydroxid (allowing for water and carbonate) is crushed quickly in a mortar and transferred to a volumetric flask. Sufficient Columbian methanol or purified wood alcohol is added to fill the flask to the mark. The flask is then shaken occasionally till the solution is complete. The carbonate which separates out should be filtered off through glass wool. The solution is now ready for standardization."

The colorimetric method of determining H-ion concentration: Some applications in the analytical laboratory, N. EVERS (*Analyst*, 46 (1921), No. 547, pp. 393-400, fig. 1).—This is a brief description of the colorimetric method of determining H-ion concentration, with a few illustrations of its applicability in testing the purity of commercial chemicals.

The sensitiveness of colored indicators at higher than ordinary temperatures, I. M. KOLTHOFF (*Rec. Trav. Chim. Pays-Bas*, 40 (1921), No. 12, pp. 775-785, fig. 1).—This paper presents data on the change in sensitiveness at temperatures of 70 and of 100° C. of some of the well-known indicators used in determining H-ion concentration. Among the points brought out are that indicators which are themselves of basic nature such as tropeolin, dimethyl yellow, methyl orange, and nitramin are less sensitive to H-ions and more sensitive to OH-ions at higher temperatures. The sensitiveness of the amphoteric indicator methyl orange does not change with increasing temperature.

The sensitiveness of the acid indicators *p*-nitrophenol, phenolphthalein, and thymolphthalein for H-ions at boiling temperature is not very different from that at ordinary temperature.

Iodometric studies, I. M. KOLTHOFF (*Ztschr. Analyt. Chem.*, 60 (1921), Nos. 9-10, pp. 338-353; 11, pp. 393-406; 12, pp. 448-457).—This is an abstract in German of the iodometric studies previously reported from their original Dutch source (E. S. R., 41, p. 504; 43, p. 204).

The use of perchloric acid as an aid to digestion in the Kjeldahl nitrogen determination, B. MEARS and R. E. HUSSEY (*Jour. Indus. and Engin. Chem.*, 13 (1921), No. 11, pp. 1054-1056, figs. 2).—A study is reported of the effect of the addition of various amounts of perchloric acid upon the digestion of such materials as casein, tankage, egg albumin, and gelatin in the Kjeldahl nitrogen determination, using a 1-gm. sample with 1 gm. of copper sulphate and 25 cc. of concentrated sulphuric acid. With these proportions it was found that 2 cc. of 60 per cent perchloric acid shortened considerably the time of digestion without affecting appreciably the accuracy of the results. Larger amounts led to a loss in nitrogen. The amount of perchloric acid added should not cause the digestion to clear in less than three minutes or fail to clear in seven minutes. **All samples should be heated at least 15 minutes after clearing.**

A micro method for the determination of ammonia, D. ACÉL (*Biochem. Ztschr.*, 121 (1921), No. 1-4, pp. 120-124).—The method described consists essentially in oxidizing the sample in a small test tube with concentrated sulphuric acid, and adding to the contents of the tube and to a similar tube containing the same amount of sulphuric acid alone Rochelle salts and Nessler's reagent. The contents of the control tube is then titrated with ammonium chlorid solution until the color matches that of the other tube. The amount of nitrogen in the sample is calculated from the amount of ammonium chlorid required for the titration. The application of this method to the determination of total and residual nitrogen in blood serum and of total nitrogen in urine is described in detail. The amounts required are 0.001 to 0.003 cc. for total nitrogen and from 0.02 to 0.025 for residual nitrogen.

A qualitative test for sour soils, N. M. COMBER (*Jour. Agr. Sci. [England]*, 10 (1920), No. 4, pp. 420-424).—The test is based upon the fact that iron which is present in sour soils passes into solution when a potassium salt is added to the soil, and can thus be detected by the addition of potassium thiocyanate in an aqueous or preferably an alcoholic solution.

Citric acid content of milk and milk products, G. C. SUPPLEE and B. BELLIS (*Jour. Biol. Chem.*, 48 (1921), No. 2, pp. 453-461).—This paper presents data on the citric acid content of milk from cows on winter and summer feed and of commercial evaporated, condensed, and dried milk.

A marked variation was found in the citric acid content of the milk from individual animals receiving the same feed. A slight tendency toward a higher percentage of citric acid in the winter milk of cows receiving silage and corn stover than in the milk of herds receiving only hay as roughage was noted. In the milk of only one herd was there a significant difference in the citric acid content of summer and winter milk. The average citric acid content of the milk from all cows on a winter ration was 0.142 per cent and from all cows on pasture 0.148 per cent. The heating of milk during the manufacture of evaporated, condensed, and dried milk had apparently no effect upon the citric acid content. This shows that the parallelism between citric acid content and anti-scorbutic properties does not hold true in the case of concentrated milk products.

The citric acid content of milk was found to decrease during aging in the presence of high acidity and to be more rapid in raw milk than in pasteurized milk.

Comparison of results in desugarization with the Steffen lime, barium, and strontium processes, M. POTVLIET (*Jour. Indus. and Engin. Chem.*, 13 (1921), No. 11, pp. 1041, 1042).—A comparison of the relative value of barium, strontium, and calcium oxids as agents for the desugarization of beet molasses is reported with the following results:

The juices from barium and strontium saccharates were much lighter in color than those obtained from calcium saccharate, and a higher yield of granulated sugar was obtained by the barium and strontium processes. The barium process is considered the most desirable, partly on account of the greater elimination of raffinose as well as being the most desirable from the point of view of extraction. The strontium process is also more economical than the Steffen lime process, although it has some of the drawbacks of the latter.

Nondefecable juice; causes and remedies, C. MÜLLER (*Bul. Inst. Égypte*, 3 (1920-21), pp. 49-59).—A study of the cause of the difficulties sometimes met with in the defecation of sugar cane juice is reported, from which the conclusion is drawn that the essential cause is the occasional presence in sugar cane of colloidal organic silica compounds. These compounds are for the most part destroyed by heating the juice to 116° C., and at this temperature the gums, which are not eliminated by ordinary defecation, are precipitated, thus reducing the amount of lime necessary to add after the heating. It is therefore recommended that in the case of sugar cane containing an excess of soluble silica the juice should be heated to 116°, followed by a moderate liming with or without sulfitation.

Studies in the clarification of unfermented fruit juices, J. S. CALDWELL (*U. S. Dept. Agr. Bul.* 1025 (1922), pp. 30).—For the purpose of devising a simple process of clarifying unfermented fruit juices in order to eliminate the preliminary pasteurization and storage for sedimentation, a systematic study was made of the usual methods of clarification employed by wine makers, brewers, and sugar manufacturers, these methods being grouped as follows: (1) Those in which the colloid is destroyed by the use of enzymes, (2) those which bring about by chemical treatment the formation of a precipitate which envelops and carries down suspended material, and (3) those in which the colloid is removed by adsorption upon insoluble, chemically inert, adsorbing agents.

The methods tested which yielded unsatisfactory results may be briefly summarized as follows: Clarification by means of enzymes, while possible, is considered too complicated and technical a process to be adapted to general use on a small scale. Clarification by the addition of such substances as tannin, gelatin, casein, etc., resulted in slow and incomplete precipitation, an alteration in the chemical composition of the juice, and a decrease in the palatability and flavor of the product. Of the inert adsorbing agents carbon proved unsuitable in that it removed the flavoring substances and color, but did not remove the pectins and gums. Silicic acid treatment proved too tedious and slow a process.

Kieselguhr, or diatomaceous earth, proved the most satisfactory agent tested and was subjected to a detailed study as to the best technique for its use. The commercial kieselguhrs were found to impart foreign flavors to the juice, owing to the presence of wax derivatives. It was found, however, that these could be removed successfully by heating the earth to redness for a short time. This treatment also proved satisfactory in the revivification of the earth after use.

The filtration of the treated juice can best be accomplished by filter presses of the plate and frame type, but, since the cost of such equipment limits its use to commercial size installations, suggestions are given for the manufacture of small filters, and methods are described which require no special equipment. For handling small quantities of juice, such as would be put up for individual

household use where a suction pump is not available, two methods are suggested. In one a cask provided with a false bottom for supporting the filter and a faucet placed just below for drawing off the juice are required. The filter disk should be made rather thick, the diatomaceous earth being packed firmly over the whole surface and along the walls of the container. For handling juice on a still smaller scale a cone-shaped bag of heavy denim can be used. The bag is first wet thoroughly, suspended, and sufficient kieselguhr made into a thin paste with water is added to fill it. After the water has drained away the treatment is repeated if necessary until the entire inner surface of the bag is covered with an adhering layer of earth, after which the water is passed through until the outer surface is washed free of the earth. In filtering, the bag should be kept practically full to the top.

Juices which are to be clarified by the use of diatomaceous earth should be allowed to stand undisturbed for from 12 to 18 hours after pressing and should then be decanted, mixed with the diatomaceous earth at the rate of 6 or 8 lbs. per 100 gal., and immediately filtered through one of the forms of apparatus described. During the filtration the juice should be thoroughly agitated occasionally to keep the earth in suspension. The rate of filtration can be considerably increased by heating the liquid before mixing it with the earth, but in general the temperature should not be allowed to exceed 130 to 140° F., and the heating should not be prolonged.

Apple, grape, and grapefruit juices thus treated are said to remain perfectly clear and transparent when bottled and pasteurized, and to retain their characteristic flavor and quality.

The bacteriology of the process for acetone and n-butyl alcohol manufacture, A. C. THAYSEN (*Jour. Inst. Brewing*, 27 (1921), No. 11, pp. 529-542, figs. 8).—This supplements the previously noted paper on the chemical changes involved in the process for acetone and n-butyl alcohol manufacture (E. S. R., 43, p. 502) by notes on the bacteriology of the process with special reference to contaminating organisms which may be present.

The most dangerous infection occasionally met with in the fermentation process was found to be a granule-forming organism to which the name *Bacterium volutans* was assigned. This organism, which is a nonspore-forming, Gram-positive, nonmotile, facultative anaerobe, acts rapidly on the fermentation mash at from 30 to 40° C., with the formation of lactic acid and traces only of acetic and butyric acids, while the production of acetone is very soon brought to a standstill.

It is emphasized that for the successful operation of a fermentation plant for acetone manufacture it is most essential that the various processes should be under strict bacteriological control. A procedure involving such control at the various stages of the process is described in detail.

The chemical constitution of soda and sulphate pulps from coniferous woods and their bleaching qualities, S. D. WELLS (*Jour. Indus. and Engin. Chem.*, 13 (1921), No. 10, pp. 936-939).—Data are reported from the U. S. Forest Products Laboratory, Madison, Wis., on the chemical characteristics of typical soda and sulphate pulps from white spruce cooked under carefully regulated and known conditions and of portions of the same pulps bleached to various degrees. The chemical constants determined were those employed by Schorger (E. S. R., 37, p. 502), with a few additional tests.

The data thus obtained show that the soda and sulphate pulps are a very pure form of wood cellulose and capable of high yields. The sulphate process was found to be much more efficient than the soda process in yielding a bleached pulp from such wood. It is thought that pulps of better quality both from a

physical and chemical standpoint are obtained by cooking the wood as little as possible and by accomplishing the purification as far as possible in the bleaching and washing operations.

METEOROLOGY.

Monthly Weather Review (*U. S. Mo. Weather Rev.*, 49 (1921), Nos. 9, pp. 481-536, pls. 17, figs. 10; 10, pp. 537-594, pls. 19, figs. 11).—In addition to detailed summaries of meteorological, climatological, and seismological data and weather conditions for September and October, 1921, and bibliographical information, reprints, reviews, abstracts, and minor notes, these numbers contain the following contributions:

No. 9.—Sky-Brightness and Daylight-Illumination Measurements (illus.), by H. H. Kimball and I. F. Hand; Note on Methods for Indicating and Measuring Correlation, with Examples, by H. W. Clough; The Texas Floods of September, 1921: General Discussion (illus.), by B. Bunnemeyer; The San Antonio Flood of September 10, 1921 (illus.), by J. H. Jarboe; Excessive Rainfall and Flood at Taylor, Tex., by J. P. McAuliffe; Wind Velocity and Rain Frequency on the South Texas Coast (illus.), by I. R. Tannehill; The Mass-Grouping of Raindrops, by W. J. Humphreys; Falling Rain and Atmospheric Pressure, by W. J. Humphreys; Do the Great Lakes Diminish Rainfall in the Crop-Growing Season? (illus.), by C. H. Eshleman (see p. 619); Snow Flurries Along the Eastern Shore of Lake Michigan (illus.), by C. L. Mitchell; A Simple Filling Apparatus for Definite Inflation of Pilot Balloons (illus.), by R. C. Lane; History of the Theories of the Winds, from the Earliest Times to the Beginning of the Seventeenth Century, by E. W. Woolard; Unusual Aurora at Juneau, Alaska, by M. B. Summers; and Heavy Rains and Floods in Luzon, Philippines, August, 1921, by J. Coronas.

No. 10.—Rainfall Maps of Latin America (illus.), by E. Van Cleef (see p. 619); Some Illustrative Types of Latin-American Rainfall (illus.), by B. O. Weitz (see p. 619); Relation Between the Rainfall, the Temperature, and the Yield of Corn in Argentina (illus.), by N. A. Hessling (see p. 619); Fruit-Frost Work in the Grand Valley of Colorado (illus.), by A. M. Hamrick; Results of Evaporation Observations, compiled by R. E. Horton (see below); The Hurricane of October 25, 1921, at Tampa, Fla. (illus.), by E. H. Bowie; The Electrical Charge of the Atmosphere and the Height of the Barometer, by W. J. Humphreys; and Pressure Maps at Three Kilometers in Japan, by S. Fujiwhara.

Meteorological records for 1920 (*New York State Sta. Rpt. 1920*, pp. 567-580).—Tables are given showing tridaily readings at the experiment station at Geneva, N. Y., of standard air thermometers for each month of 1920; daily readings of maximum and minimum thermometers at 5 p. m. for each month of the year; a monthly summary of maximum, minimum, and standard thermometer readings for the year; monthly and yearly maximum and minimum temperatures from 1883 to 1920, inclusive; yearly maximum and minimum temperatures since 1883; monthly and yearly means of temperatures since 1883; monthly rainfall since 1882; and total precipitation, rainfall and snow, by months, 1918 to 1920. The mean temperature of 1920 was 47.4° F.; the highest temperature 94°, June 29; the lowest -16°, January 31 and February 1. The mean temperature, 1883-1920, was 46.7°. The total precipitation (rain and snow) for 1920 was 37.24 in.; the rainfall only was 28.56 in. as compared with 27.72 in. for the period 1882-1920.

Results of evaporation observations, R. E. HORTON (*U. S. Mo. Weather Rev.*, 49 (1921), No. 10, pp. 553-566).—This is a compilation of observations by the Bureau of Plant Industry, U. S. D. A., at 28 places in the drier regions of the western United States.

The observations were made, as a rule, with pans of galvanized iron 6 ft. in diameter and 24 in. deep, buried 20 in. in the soil and kept filled with water to the soil surface level, or 4 in. below the rim of the pan. The tabulated data show not only the period of observation but the latitude and elevation above sea level of the places of observation, as well as the air temperature, mean water surface temperature, wind velocity, vapor pressure, and observed evaporation in inches per month.

Do the Great Lakes diminish rainfall in the crop-growing season? C. H. ESHLEMAN (*U. S. Mo. Weather Rev.*, 49 (1921), No. 9, pp. 500-502, fig. 1).—The article is summarized as follows:

"During the severe drought in the early summer months of 1921, at Ludington, Mich., showers frequently seemed to avoid the shore of Lake Michigan. This led the writer to investigate the question whether or not the lake actually causes a diminution in the normal amounts. The records show an area of maximum fall in the interior of extreme southern Michigan, in May, June, and July. In August and September the area is absent. Less rainfall occurs along the eastern than the western shore of Lake Michigan, and there is a maximum area in the interior of Wisconsin. Apparently the Lakes do cause some diminution. The probable cause is the lake breezes during the middle of the day and the afternoon, strongest in May, June, and July, which promote circulation and have a lateral movement that prevents the ascending currents needed for local thunderstorms. In general, however, the monthly amounts are sufficient for agricultural interests."

The results reported in this paper are in agreement with those of observations on the effects of lakes on the climate of Wisconsin reported by E. R. Miller in an article previously noted (*E. S. R.*, 38, p. 317).

Rainfall maps of Latin America, E. VAN CLEEF (*U. S. Mo. Weather Rev.*, 49 (1921), No. 10, pp. 537-540, pls. 3).—Maps based upon rainfall data from all available sources, showing annual and summer and winter rainfall in Central and South America, are given and the rainfall distribution is explained.

Some illustrative types of Latin-American rainfall, B. O. WEITZ (*U. S. Mo. Weather Rev.*, 49 (1921), No. 10, pp. 540-542, fig. 1).—Graphs are given which show the monthly distribution of rainfall at selected stations in Latin America, grouped as follows: (1) Mexico, Central America, and the West Indies; (2) western coast of South America (3 sections); (3) northeastern South America and the basin of the Amazon; and (4) eastern South America, Brazil, Argentina, Paraguay, and Uruguay.

Relation between the rainfall, the temperature, and the yield of corn in Argentina, N. A. HESSLING, translated by G. B. DIEHL (*U. S. Mo. Weather Rev.*, 49 (1921), No. 10, pp. 543-548, figs. 6).—As a result of an attempt to correlate the yield of corn with rainfall and temperature, the author concludes that the most important factor in the yield of corn in Argentina is the rainfall from October to January, inclusive, and that the factor next in importance is the temperature during the same period. Although these are not the only factors involved, if they are known it is deemed possible to calculate the yield with a sufficient degree of accuracy.

SOILS—FERTILIZERS.

Weathering and soil formation as an introduction to soils, R. LANG (*Verwitterung und Bodenbildung als Einführung in die Bodenkunde. Stuttgart: E. Schweizerbart. Verlagsbuchhdlg.*, 1920, pp. [5]+188, figs. 8).—This book deals with both the mineral and organic phases of soil, and is intended as a guide in the study of the transformation of rocks and plants into soil. The study of

soils is considered as a branch of geology, and soils are considered to be the product of the weathering of stones and the decomposition of plants. On this basis the processes of weathering and decomposition are given extensive first treatment as subjects of prime importance.

It is concluded that weathering is essentially a climatic process which can be divided into cold and hot weathering. Cold weathering takes place at temperatures from the freezing point downward and is thought to have only physical and mechanical effects upon stones. Hot weathering takes place at temperatures from the freezing point upward, and its action is considered to be both physical and chemical. Plant decomposition is thought to consist of the combined action of water, atmospheric oxygen, and aerobic bacteria.

The main portion of the book is devoted to soil formation, including residual soils, sedimentary soils, and so-called cultural soils. Residual soils are classified into five groups according to the presence or absence of humus and the salt content. The soils containing no humus are in two groups, namely, those containing an excess of mineral salts, including salty, silty, and sandy soils, and those in which mineral salts are not in excess, including yellow and red soils and laterite. The soils containing adsorptively saturated humus and in which mineral salts are in excess include salty black soils and black lime soils, and those in which mineral salts are not in excess include brown soils and pure black soils. Soils containing adsorptively unsaturated humus and which are deficient in mineral salts include raw humus and bleicherde. The sedimentary soils include aeolian, alluvial, marine, and glacial soils. Cultural soils are the result primarily of artificial practices, such as drainage, irrigation, and general soil management.

Fundamental principles established by recent soil investigations, M. WHITNEY (*Science, n. ser.*, 54 (1921), No. 1398, pp. 348-351).—A brief review is given of the fundamental principles established by modern methods of soil investigation in the Bureau of Soils, U. S. D. A., during the past 20 or 30 years. Special attention is drawn to findings relating to soil texture, organic chemistry of soils, mineral chemistry of the soil solution, and ultra clay.

The contribution of soil surveys to soil science, C. F. MARBUT (*Soc. Prom. Agr. Sci. Proc.*, 40-41 (1919-1920), pp. 116-142, fig. 1).—A comprehensive review is given of the procedure followed in the soil survey work by the Bureau of Soils, U. S. D. A., together with a general statement of results attained in this work. It is pointed out that the soil surveys have created a new branch of soil science which is termed soil anatomy, in that it treats of the number, position, arrangement, and character of the various types of which the soils of the country as a whole are made up.

Chemical analysis of soils: Its value and limitations, J. CRABTREE (*Jour. Bd. Agr. Brit. Guiana*, 14 (1921), No. 4, pp. 218-225).—Considerable data from different sources on the chemical analysis of soils are summarized and the conclusion drawn that chemical analysis alone can, in the present state of knowledge, indicate whether a soil is or is not fertile. It can usually elucidate cases of pronounced infertility in apparently fertile lands, but its greatest value directly to the everyday operations of the practical man is usually in conjunction with field trials.

Chemical nature of clay obtained by the Atterberg method, E. BLANCK and F. PREISS (*Jour. Landw.*, 69 (1921), No. 2, pp. 73-77).—Studies of the uniformity in composition of raw clay obtained by mechanical analysis of soil by the Atterberg method are reported. The clay fraction was divided into 26 subfractions. Chemical analyses of each subfraction showed that the first 10 fractions, including about 80 per cent of the total clay, had a fairly con-

stant composition closely approximating that of the theoretical clay complex, $Al_2O_3 \cdot 2SiO_2 \cdot 2H_2O$. The remaining subfractions consisting of coarser materials showed a gradually increasing silica and sand content.

It is concluded that mechanical analysis of soil by the Atterberg method effects a satisfactory separation of the true clay fraction.

The knowledge of red soils, E. BLANCK and F. PREISS (*Jour. Landw.*, 69 (1921), No. 2, pp. 79-96).—Studies on the origin and manner of formation of certain red soils, particularly those occurring in Mediterranean regions, are discussed.

Acid soils, R. M. SALTER (*Ohio State Univ., Timely Soil Topics*, No. 43 (1921), pp. [4]).—Brief popular information on the nature and treatment of acid soils under Ohio conditions is presented.

Inversion of cane sugar by mineral acid soil, S. OSUGI (*Ber. Ōhara Inst. Landw. Forsch.*, 1 (1920), No. 5, pp. 579-597).—Studies on the inverting power of acid soils are reported which showed that mineral acid soils can invert cane sugar without exception. The inverting activity of acid soil is attributed mainly to the nature of the soil particles, and was found to have an intimate relation to the degree of acidity of its potassium chlorid extract. The inversion reaction by acid soil was monomolecular. Some aluminum sulphate and chlorid which reacted acid were found in the water extract of acid soil, but these had only a very slight influence upon cane sugar.

While silicic acid gel can invert cane sugar, it was not detected in acid soil. Acid aluminum silicate is concluded to be the main substance giving acid soil so great an inverting activity. It is further concluded that the hydrogen-ion concentration of the water extract of acid soil is not enough to explain the inverting action of soil without assuming a greater concentration of the hydrogen ion around the soil particles than of the mass of the soil solution.

Importance of liming humus soils, S. ODÉN (*Internatl. Mitt. Bodenk.*, 9 (1920), No. 5-6, pp. 375-390, pl. 1, figs. 7).—The author summarizes studies by himself and others, and draws the conclusion that the so-called acid character of unlimed humus soils is due not so much to the humus acids themselves as to adsorbed simple organic acids which hinder bacterial activity and the purely chemical processes. So-called calcium humate, originating from the reaction of humus acids with lime in limed humus soils, is considered to be of greater importance in such soils than pure lime, since it is thought to be a salt of the more insoluble acids and is washed out of the soil with greater difficulty than lime. It is further concluded that the adsorbed injurious organic acids are neutralized by calcium humate setting free the noninjurious humin acids which permit the development of soil organisms.

Studies of the fixation of water by limed and unlimed humus soils showed that limed soils always fixed more water than the unlimed soils, although the difference was often very small. It was also found that the water was a little more firmly fixed in limed soils and was not so available to plants. Soils rich in humus fixed more water and were more retentive thereof than soils rich in ash.

Physico-chemical studies on the absorptive power of soils and on the manner in which plants absorb nutritive material from the soil, L. CASALE (*Staz. Sper. Agr. Ital.*, 54 (1921), No. 1-3, pp. 65-113; *abs. in Jour. Soc. Chem. Indus.*, 40 (1921), No. 19, p. 710A).—Studies are reported which showed that the colloidal constituents of soil are part positively and part negatively charged. Absorption in soils is due to the reaction of the charged colloids with the anions and cations of the soil solution. The amount of absorption of these ions and their coagulating effect on the colloids are carefully balanced. Iron and aluminum are the most powerful coagulants, followed in order by magnesium, calcium, potassium, ammonium, and sodium.

The rate of absorption of cations is greatest for potassium and ammonium, followed in order by calcium, magnesium, and sodium. The ions are attached to the colloidal membrane in the order in which they are attracted. Absorption and substitution are governed by the potential difference between the colloids and the soil solution.

The absorptive power of soil colloids, notably the basic silicates and humates, is destroyed by boiling hydrochloric acid. Organic colloids have a slightly smaller negative charge than the inorganic and need strong electrolytes to coagulate them.

With regard to the assimilation of nutrients by plants it is concluded that the ectoplasm of the absorbing plant cells has a slightly lower negative charge than the soil colloids, so that a difference in potential exists between plant and soil. Thus the plant is nourished as a result of the subsequent migration of the ions.

The acidity produced in culture solutions during the growth of plants did not occur where colloids were added to absorb the hydrogen ions. It is concluded that the action of fertilizers may be due to their power to regulate the difference in potential between the plant and the soil solution.

Influence of temperature on the absorbing properties of soil, J. STOQUER (*Compt. Rend. Acad. Agr. France*, 7 (1921), No. 35, pp. 751-755; also in *Compt. Rend. Acad. Sci. [Paris]*, 173 (1921), No. 17, pp. 731-733).—Studies on the influence of temperature on the power of four different soils to absorb ammonia from dilute solutions of ammonium sulphate are reported. The temperature range was 0, 16, 35, and 55° C., and the concentrations of the ammonium sulphate solutions used were 0.02, 0.08, and 0.4 parts per 1,000.

It was found that the absorbing power increased with the concentration of the solution. For three of the soils the absorbing power was negative with the solution of lowest concentration, and in one case it was negative with a solution concentration of 0.08 parts per 1,000. All of the soils yielded up ammonia to distilled water. This was specially true with the higher temperatures. The absorbing power of all the soils for ammonium sulphate decreased as the temperature increased.

The influence of wheat straw on the accumulation of nitrates in the soil, H. SCOTT (*Jour. Amer. Soc. Agron.*, 13 (1921), No. 6-7, pp. 233-258, figs. 8).—In a contribution from the Kansas Experiment Station, greenhouse and field experiments on silt loam soil to determine the influence of wheat straw on the accumulation of nitrates in soil are reported.

It was found that applications of straw to soil in the greenhouse caused a marked decrease in the nitrate content, which was proportional to the amount of straw added. As decomposition of the straw progressed, the nitrates in the soil increased, but remained lower in the presence of straw than in the untreated soil. The addition of nitrogen as ammonium sulphate with the straw caused a more rapid accumulation of nitrates.

Heavy fall applications of straw to wheat growing in the field retarded growth the following spring, delayed the ripening of the grain, and reduced the yield, except on soils having a high nitrate content when the straw was applied. Four tons of straw per acre worked into the surface 6 in. of uncropped soil resulted in a lower nitrate content the following spring, but during the summer the accumulation of nitrates was equal to that in the untreated plats. Two tons of straw per acre worked into the surface 6 in. did not lower the nitrate content of the soil the following spring.

Four tons of straw applied as a top-dressing reduced the nitrate content the following spring and summer. This treatment showed throughout the summer

the highest moisture content, the lowest temperature, and the lowest nitrate content of any of the treatments. Two tons of straw applied as a top-dressing did not show any appreciable decrease in nitrates the following spring, and the accumulation of nitrates was fairly great by the end of the summer.

Green manuring and soil management, G. N. BLACKSHAW (*Rhodesia Agr. Jour.*, 18 (1921), No. 5, pp. 455-460, pl. 1).—Information on the manuring of Rhodesia soils is summarized, based largely on experiments conducted at the Salisbury Experiment Station. The importance of turning under a green manure crop while the land is moist, in order to insure the decomposition of the vegetable matter before the succeeding crop is planted, is emphasized.

Science and crop production, E. J. RUSSELL (*Abs. in Nature [London]*, 108 (1921), No. 2708, pp. 116-120, figs. 2).—This is an abstract of a farmers' lecture of the British Association delivered at Edinburgh, in which a review is given of studies conducted at the Rothamsted Experimental Station on the use of manure and fertilizers in relation to crop production. The summarized results of long-time experiments are taken to indicate that it is only a first approximation to say that artificial fertilizers are equally as good as barnyard manure. It is pointed out that barnyard manure produces effects of the highest importance to the land which no known combination of artificial fertilizers will bring about.

It is shown that barnyard manure differs in two ways from artificial manures. The variation in yield from year to year is diminished by the use of barnyard manure, as is also the deterioration in fertility due to continuous cropping for a period as long as 80 years. On the other hand, tests with at least 15 different combinations of artificial fertilizers have shown that the results fluctuate considerably from season to season and deteriorate as the years pass by. Barnyard manure never did badly even in the worst seasons, but it did not yield record crops even in the best seasons.

The deterioration in yield from plats treated with artificial fertilizers has been marked, especially on the wheat and barley plats, and has been greatest where one of the essential fertilizer constituents was withheld. General means of improving crop production are discussed.

The variation of the soluble salts in soil and in the sedimentation curve from fertilized plats during the development of turnips, W. GEILMANN and A. VAN HAUTEN (*Jour. Landw.*, 69 (1921), No. 2, pp. 105-130).—Studies are reported in which soil samples were taken simultaneously from a series of differently fertilized plats throughout the period of growth of turnips. Sedimentation curves were obtained for all samples according to the Wiegner method, and chemical analyses of water extracts were made to determine the contents of total nitrogen, sulphates, lime, magnesium, sodium, and potash.

It was found that the soluble salt contents and the sedimentation curves are influenced to a large extent by fertilization and by changes in soil moisture content. Both were subject to considerable variation during the period of growth of the turnips.

Fertility-rotation experiments, W. McFARLANE and K. A. CHING (*Hawaii Sta. Rpt.* 1920, pp. 32-34).—The results of experiments to determine the best method of cropping and fertilizing the impervious pineapple soils of Maui are tabulated. These results are taken to indicate the lack of available plant nutrients in these soils.

Soil fertility and crop quality, J. F. LYMAN (*Ohio State Univ., Timely Soil Topics*, No. 42 (1921), pp. [4]).—Brief popular information is given on the relation of soil fertility to the quality of crops.

The relation of soil fertility to vitamin content of grain, J. F. McCLENDON and A. C. HENRY (*Science, n. ser.*, 54 (1921), No. 1402, pp. 469, 470).—In a brief contribution from the University of Minnesota, experiments are reported with barley grown on untreated and on burned peat, and with oats grown on peat soil as contrasted with ordinary mineral soil.

The results showed that burning of the peat rendered the mineral matter more available to the plants and increased the yield. It also increased the amount of phosphoric acid in the grain and the vitamin content. These experiments are considered to confirm those of others, in showing that the vitamin content of milled grains is proportional to the content of phosphoric acid. While in the case of milled grains the variation in phosphoric acid content is ascribed to its partial removal in milling, it is stated that in these experiments the variation is due to the amount of available phosphoric acid in the soil.

Top-dressing meadow, G. L. SCHUSTER (*Delaware Sta. Bul.* 129 (1921), p. 8).—The average annual yields for eight years from eight meadow plats seeded with timothy, alsike clover, and alfalfa and top-dressed each spring with different fertilizers are tabulated.

Improvement of grazed pastures by manuring, T. J. JENKIN (*Jour. Min. Agr. [London]*, 28 (1921), No. 3, pp. 239-247).—Botanical data obtained from manurial experiments under three different sets of conditions on very poor pastures in North Wales are presented in this report, which is a contribution from the University College of Wales.

A very noticeable improvement from manuring was observed in some cases under all three conditions. In each case a marked improvement was accompanied by a decided and apparently corresponding increase in the total number of plant units per area. Marked improvement was also invariably accompanied by a corresponding increase in the proportion of white clover. In one case improvement was accompanied by a decrease in the proportion of bent grass, which, however, stood originally at a high figure. At the other two centers this proportion increased. At one center sheep's fescue was profoundly affected by basic slag and Gafsa phosphate.

In general equal quantities of high-grade basic slag and ground Gafsa phosphate gave nearly equal results, but the botanical data strongly suggest that Gafsa phosphate was the more effective. In one case improvement by means of these manures was quickly followed by a great deterioration, and it appeared that the changes induced by them in the first instance were so great that the pasture was incapable of returning directly to its original condition. Superphosphate with ground lime gave very good results which were, however, not so good as those with basic slag and Gafsa phosphate. Superphosphate alone was in all three cases inferior to the fertilizers and combinations thereof mentioned above. Ground limestone alone caused an improvement in only one case.

Effects of manures and of cake feeding on Hanging Leaves pasture fields (*County Northumb. Ed. Com. Bul.* 33 (1921), pp. 20-24).—These experiments were conducted on poor clay and clay loam soils lying on a subsoil of poor yellow boulder clay. Basic slag was found to be a most effective manure for improving poor pasture of this kind. Potash fertilizers were not needed. The soil was distinctly deficient in nitrogen, but it was found that this element was abundantly collected by the roots of clover and other leguminous plants which are favored by the slag. This is considered the reason that the nitrogen of neither cotton cake nor fish meal gave effective returns. Some improvement was evident from the use of lime with slag on these soils.

Manures for pasture in Tree field (*County Northumb. Ed. Com. Bul.* 33 (1921), pp. 13-20).—Experiments extending over 23 years on the manuring of poor stiff clay pasture soil lying on boulder clay are summarized.

Repeated dressings of basic slag continued to be effective. Potash fertilization up until the twenty-first year of the experiments continued to be unprofitable on this soil. Sodium nitrate added to basic slag depressed the results given by the slag. Decorticated cotton cake fed to sheep in the first three years resulted in an annual loss equal to that in the last three years when no cake was fed. The cake did not give a profitable return from the sheep in the years in which it was fed to them, and it showed little residual value as a fertilizer in the later years. Nitrogen from the cake had the same effect on the herbage as nitrogen from sodium nitrate. The fifth and sixth dressings of dissolved bones gave poor results when compared with basic slag. A dressing of 1,000 lbs. of basic slag per acre gave more profitable results than the same amount of slag applied in two dressings. Lime did not give profitable results in conjunction with slag.

Increase or decrease of nitrogen in the soil by manuring (*County Northumb. Ed. Com. Bul. 33 (1921), pp. 24-39*).—Experiments on old hay land are reported which showed the striking effect of phosphatic or of phosphatic and potassic manures in increasing the collection of nitrogen in such soil. This is attributed to their favorable influence on the development of clover and other leguminous crops. On the other hand, when a nitrogenous manure was added the development of these plants was checked, and the increase in nitrogen in the soil was largely prevented.

In further experiments on a light sandy soil supporting an old and very thick and matty pasture, similar results were obtained. Basic slag gave the best results, but potash manure alone had no effect. It was found that basic slag was considerably more effective than bone meal on both light and heavy soils. Experiments to compare the various forms of lime on a black sandy loam soil supporting old pasture showed that ground lime was more effective than ground limestone, and both gave better results than ordinary lime. Slag gave nearly as good results without as with lime. Superphosphate gave poor results when used alone, but good results when used with lime.

Action of dicyandiamid on plant growth, E. JOHNSON (*Nord. Jordbrugs-forsk., 1919, No. 6, pp. 267-272; abs. in Zentbl. Agr. Chem., 50 (1921), No. 9, pp. 334-336*).—Further studies on the action of different nitrogenous fertilizers and mixtures thereof, to determine the influence of the dicyandiamid content on the growth, yield, and composition of grain crops, are reported (E. S. R., 41, p. 815).

Urea, ammonium sulphate, and sodium nitrate gave about the same general results, and were given a rating of 100. On this basis oiled lime nitrogen containing 3 per cent of dicyandiamid, Norwegian lime nitrogen containing 21 per cent of dicyandiamid, and a urea-dicyandiamid mixture containing 33 per cent of dicyandiamid received a rating of 99, granulated lime nitrogen containing 7 per cent of dicyandiamid 80, a urea and dicyandiamid mixture containing 66 per cent of dicyandiamid 59, and granulated lime nitrogen containing 10 per cent of dicyandiamid 45.

It is noted that urea gave slightly better results than ammonium sulphate and sodium nitrate in the smaller applications, and vice versa in the larger applications. Norwegian lime nitrogen and granulated lime nitrogen acted in general the same as corresponding mixtures of urea and dicyandiamid, the greater the dicyandiamid content the smaller being the maximum yield.

Smaller contents of dicyandiamid had no toxic influence on straw and grain yield. An increase in nitrogen fertilization increased the grain more than the straw. Pure dicyandiamid in small applications injured the later growth of crops, although no injurious influence on germination was noted. It is concluded that the action of dicyandiamid depends primarily upon the concentration in which it is applied.

Preparation of nitrogenous potassic fertilizers by means of explosives with an ammonium nitrate base, F. GARELLI and A. ANGELETTI (*Gior. Chim. Indus. ed Appl.*, 3 (1921), No. 9, pp. 415-417).—Experiments on the use of war explosives, consisting wholly or in part of ammonium nitrate, in the preparation of nitrogenous potassic fertilizers are reported.

It was found that 100 parts of peat containing 15 per cent of moisture absorbed 150 parts by weight of a solution of explosive containing 80 per cent of ammonium nitrate by volume. The resulting fertilizer contained 28 per cent of moisture and 13 per cent of nitrogen. This was dried to a moisture content of 20 per cent.

In studies to devise methods of transforming concentrated solutions of ammonium nitrate into solid products without the necessity of evaporation, experiments were conducted with potassium chlorid, potassium sulphate, and sodium chlorid. Commercial potassium chlorid was apparently completely consumed up to a certain amount by a boiling solution of ammonium nitrate. A mixed salt was obtained on filtration containing 16.82 per cent of total nitrogen and 31.15 per cent of potash. Ten per cent of the nitrogen of the solution of explosive remained in the filtrate. It was found that this could be utilized through absorption by peat, resulting in a peat-nitrogenous-potassic fertilizer containing from 4.6 to 4.7 per cent of total nitrogen and from 11 to 11.5 per cent of potash.

The results obtained with potassium sulphate were not so satisfactory. The potassium sulphate did not seem to react readily with a boiling solution of ammonium nitrate, and apparently only a low-grade product resulted. A partial precipitation of ammonium nitrate from solution was possible with sodium chlorid, resulting in a mixture of ammonium nitrate, sodium nitrate, sodium chlorid, sodium nitrate, and ammonium chlorid, with a total nitrogen content of about 19 per cent.

Potash shales of Illinois, M. M. AUSTIN and S. W. PARR (*Jour. Indus. and Engin. Chem.*, 13 (1921), No. 12, pp. 1144-1146, fig. 1).—The substance of this report has been previously noted from another source (E. S. R., 45, p. 120).

An American source of potash and soil improvement, R. STEWART (*Soc. Prom. Agr. Sci. Proc.*, 40-41 (1919-1920), pp. 143-152, pls. 4).—In a contribution from the University of Nevada a series of experiments, conducted at the Illinois Experiment Station, on the value of finely ground leucite, alunite, ignited alunite, and potassium-bearing shale as sources of potash for soil improvement are reported.

In greenhouse experiments with peat soils these four materials were compared with kainit on wheat, oats, and clover. The potassium was applied in like amounts at the equivalent rate of 500 lbs. of potassium sulphate per acre. Finely ground limestone was also applied at the rate of 5 tons per acre. It was found impossible to secure a normal growth of either wheat or oats in any of the pots even where kainit was added, as the plants turned yellowish brown at the end of five or six weeks and no further growth took place. This condition persisted throughout the entire four years of the experiment, and as a result corn and buckwheat were substituted for wheat and oats with very favorable results.

Kainit increased the yield of corn 326 per cent and of clover 121 per cent. Leucite increased the corn yield 126 per cent and the clover 60 per cent. Alunite gave some indications of being beneficial to corn, but its effect on clover was negative. The addition of sodium chlorid and magnesium chlorid in an attempt to produce artificial kainit was no more effective than the leucite.

In further experiments ignited alunite gave remarkable increases of nearly 800 per cent. Experiments with other crops, including rape, beets, and flax,

gave corresponding results. Experiments with potash-bearing shale gave larger increases in yield than any other form of potassium used, especially on clover, rape, corn, and buckwheat.

These results are considered to be of striking and of such possible economic importance as to warrant more extended investigations in the field. No conclusions are drawn.

Solubility of leucite in arable soil, G. DE ANGELIS D'OSSAT (*Atti R. Accad. Naz. Lincei*, 5. ser., *Rend. Cl. Sci. Fis., Mat. e Nat.*, 30 (1921) I, No. 12, pp. 379-383; *abs. in Jour. Soc. Chem. Indus.*, 40 (1921), No. 19, pp. 710A, 711A).—In connection with studies of leucite as a source of potash in soil, vitreous fragments of leucite, weighing 96.853 gm. and having a total surface area of 0.31 square meter (3.3 sq. ft.), were kept in distilled water for six months. The water was changed each month and the total volume used was 1.5 liters. The mineral had a theoretical potash content of 20.82 gm. During this time the mineral lost 0.124 per cent of its weight but showed no visible alteration. The non-soluble dissociated part assumed the form of a gel, and the water cleared immediately after mixing.

A second quantity of 69.345 gm. of leucite, with a surface area of 0.04 square meter (0.43 sq. ft.), when treated for six months with 800 cc. of 2 per cent citric acid solution lost 0.677 per cent of its weight, corresponding to 0.145 gm. of potash. In this case also no superficial alteration was evident.

Investigations and experiments at the Moor Experiment Station in Bremen.—III, **Influence of raw potash salts upon soil moisture**, B. TACKE (*Mitt. Ver. Förd. Moorkult. Deut. Reiche*, 39 (1921), No. 18, pp. 337-343).—In a third and final report of this series (*E. S. R.*, 46, p. 215), the author reviews studies by himself and others bearing on the subject, and reports three years' experiments with different crops. These showed that fertilization with raw potash salts in comparison with pure salts does not facilitate the assimilation of moisture by plants in times of drought but makes it more difficult.

Behavior of different plants toward difficultly soluble phosphates, C. PFOTENHAUER, T. PFEIFFER, and A. RIPPEL (*Jour. Landw.*, 69 (1921), No. 3, pp. 165-183).—In further studies (*E. S. R.*, 45, p. 217) experiments are described which led to the conclusion that different plants are physiologically dissimilar in their action, in so far as the absorption of phosphoric acid from difficultly soluble phosphates is concerned.

Control suggestions in the manufacture of acid phosphate, R. L. UPSHUR, JR. (*Amer. Fert.*, 55 (1921), No. 13, pp. 29-31).—Suggestions are made in this article relative to the control of important processes in the manufacture of acid phosphate. Fifteen special points are emphasized. One of the most important is considered to be the accurate proportioning by weight or measure of the quantity of sulphuric acid to use per charge or mixing, to a given weight and analysis of ground phosphate rock. When used it should be kept to a calculated strength equivalent to 52° B. at 60° F., at which dilution it produces the best results. A dilution table is given for this purpose.

The commercial minerals of California, W. O. CASTELLO (*Calif. State Mining Bur. Bul.* 87 (1920), pp. 124).—This bulletin is a compilation of a series of articles giving practical information on the great variety of mineral products of California. Sections are included on chalk, gypsum, nitrates, phosphate rock, potash, sulphuric acid, sulphur, and petroleum.

AGRICULTURAL BOTANY.

Report of the department of plant physiology, E. M. R. LAMKEY (*Dela-ware Sta. Bul.* 129 (1921), pp. 28-30).—The author has previously pointed out (*E. S. R.*, 45, p. 626) that the anion, or negative radical, may influence per-

meability more than cations which differ in kind or valency. Further studies of this problem are said to have shown that toxic effects and permeability may be altered by the use of compounds giving identical ions but having a changed ratio of anion to cation. It is claimed that the specific effect of any given salt does not depend entirely on the fact that the positive element of a compound is monovalent or divalent or that it may be an alkaline earth or an alkaline metal, but is the resultant of the individual effects of each ion itself upon permeability. It is further believed that much of the antagonisms between two compounds, having the one a monovalent and the other a divalent positive ion and both having a common negative ion, is due not so much to the difference in kind of the positive ions as it is to the changing concentration of the common, nonmetallic ion present in different mixtures of the two compounds.

Further studies have been made of the reactions of enzymes to solutions within the peach plant. The results obtained are said to indicate that the enzymatic processes do not keep step as the vegetative activity of the tree increases, but that the enzymatic response to the addition of the compounds used as commercial fertilizers is markedly specific and affects the various enzymatic activities differently.

An application has been made of processes previously reported (E. S. R., 45, p. 626) regarding enzymatic activity as associated with habit of growth and food content of plants by using the data to form new indices in the selection and breeding of four strains of corn. By this method the author has secured highly inbred corn that in some cases equaled crossbred corn in vigor, and crosses between strains of the original close-bred type resulted in some very promising forms.

The original varieties of sweet peas reported in this investigation, and strains of garden peas, have shown a marked variation and are still being investigated.

A simple method for growing plants, J. M. BRANNON (*Amer. Jour. Bot.*, 8 (1921), No. 3, pp. 176-178, fig. 1).—In the course of certain experiments not yet reported, it was found that neither the agar-culture method nor the water-culture method was satisfactory for growing green plants in the dark. In investigations on the organic nutrition of plants, however, it was noted that seeds would germinate and seedlings would grow even when entirely immersed in a liquid medium, and it was decided to test the possibility of using such liquid cultures. Striking successes were obtained, and the superiority of this method for growing plants in the dark over the agar method or the water-culture methods hitherto used was at once apparent.

In the work here briefly reported, the seeds were sterilized by the calcium hypochlorite method of Wilson (E. S. R., 35, p. 46). This method of growing plants in the dark (which may also be used for growing plants in the light) was employed with flax, alfalfa, corn, peas, and timothy, and the results are briefly detailed.

The special advantage of this method lies in the fact that the plants used will live and grow for a much longer time than by other methods. It would seem, in the case of plants grown in the dark, that the sugars are either too slowly absorbed by the roots or that conduction of the sugars is too slow to satisfy the needs of the plant for organic matter. When a portion of the stem of the plant is also immersed, the stem probably absorbs sugars, and so the needs of the plant are more nearly met. Another advantage over the agar method is the greater ease of analyzing the solution, since in the agar method the agar must first be removed before the sugar determination can be made. Adsorption phenomena play a part in the precipitation of agar, and thus another source of error is introduced by that method.

The effect of salt proportions and concentration on the growth of *Aspergillus niger*, C. M. HAENSELER (*Amer. Jour. Bot.*, 8 (1921), No. 3, pp. 147-163, figs. 6).—In this work, *A. niger* was grown on three-salt solutions of total concentrations equivalent to 0.5, 2.1, and 4.2 atmospheres, respectively. For each total concentration 36 solutions were made, representing all the possible combinations obtained by varying the partial concentrations of each of the salts by increments of one-tenth of the total concentration. A number of solutions in which the salt proportions and total salt concentration remained the same, but in which sugar concentrations varied from 1 to 8 atmospheres by increments of 1 atmosphere, were also tested. Results are detailed with discussion.

A preliminary study on the mineral nutrition of young cotton plants, R. B. ESPINO (*Philippine Agr.*, 8 (1920), No. 10, pp. 335-343).—The present study, dealing with the mineral nutrition of young cotton plants, is preliminary in character and does not claim to have solved to any extent the problem of the mineral food of this plant. It is thought to have been the first study of its kind in the Philippines, suggesting the need of further investigation.

One object was the determination, by actual cultural test, of the sets of salt proportions best suited to the improvement of the cogon soil as regards physical or chemical properties, looking to the profitable conversion of vast areas of cogon soil now idle and nonproductive and often containing substances toxic to ordinary crop plants.

Pot tests improved cotton yields as much as 397 per cent over the unfertilized controls. Apparently the best salt proportion here tested is one having an extraordinarily high content of calcium nitrate. As an average of the salt proportions of the two cultures that proved to be the best under the five criteria here employed, the best culture would have 1.5 parts by volume of KH_2PO_4 , 14 parts of $\text{Ca}(\text{NO}_3)_2$, and 2 parts MgSO_4 . It appears also that the cogon soil can be improved chemically or nutritively, at least for the young cotton plant, by the addition of $\text{Ca}(\text{NO}_3)_2$, or probably any commercial fertilizer containing both the calcium and the nitrate radicals. In other words, the cogon soil is probably deficient in these salts or radicals thereof.

The influence of iron in the forms of ferric phosphate and ferrous sulphate upon the growth of wheat in a nutrient solution, L. H. JONES and J. W. SHIVE (*Soil Sci.*, 11 (1921), No. 2, pp. 93-98, pl. 1, fig. 1).—The authors report the results of a brief study of the influence of varying amounts of iron upon the growth and general appearance of spring wheat when supplied to the plants in a nutrient solution in the forms of the insoluble ferric phosphate and the soluble ferrous sulphate, spring wheat of the Marquis variety being used, and the general culture method adopted by Shive (*E. S. R.*, 36, p. 328) being followed throughout.

It appears that in the nutrient solution here employed iron in the form of ferric phosphate is very slowly and difficultly available to wheat plants even when supplied in relatively large quantities, and that it is not suitable for use with spring wheat in the culture solution here employed if the plants are to be grown beyond the stage of development when the reserve iron in the seed is no longer adequate to supply the needs of the plants. Ferrous sulphate, on the other hand, appears to be readily available to these plants, but somewhat toxic in the highest concentration used. It gave most excellent results when supplied to the culture solution here used in quantities of 0.75 to 3 mg. of iron per liter of solution.

Influence of temperature on the relations between nutrient salt proportions and the early growth of wheat, W. F. GERICKE (*Amer. Jour. Bot.*, 8 (1921), No. 2, pp. 59-62).—Preliminary results are reported of an experimental

study carried out in 1918-19 bearing upon the general relation noted by Russell (E. S. R., 39, p. 512), and upon phases of relations believed to exist between climatic conditions and what may be regarded as the best set of proportions of the nutrient salts in the medium in which the plants are rooted.

The germination and early seedling phases in the development of Marquis wheat were studied, the investigation being planned to bring out the relations between maintained temperature, on the one hand, and the physiological properties of various nutrient solutions on the other. The nutrient solutions used were the 126 three-salt solutions described by the committee on salt requirements (E. S. R., 44, p. 130), and each solution was tested for every one of the seven different temperatures. These three-salt solutions are of six types (E. S. R., 40, p. 520), according to the salts employed, and 21 different solutions were tested for each type, each of these having its own peculiar set of salt proportions.

The present paper is confined to certain points brought out for the two temperatures 28 and 17° C. (one about optimum and the other distinctly below the optimum temperature for the early growth phases of wheat). It appears from the data as tabulated that the good group of each of the six types of solution comprises from 2 to 7 different solutions, also that there is generally a marked difference between the sets of salt proportions that proved good with the higher temperature, on the one hand, and those that proved good with the lower ones, on the other.

It is concluded from the results as presented that temperature is of prime importance in determining the mineral requirements for good germination and initial growth in Marquis wheat, at least within the general limits of these experimental tests, and it is considered safe to suppose that other climatic conditions may be influential.

The forms of nitrogen in soy bean nodules, W. H. STROWD (*Soil Sci.*, 11 (1921), No. 2, pp. 123-130).—The first product of nitrogen assimilation by legume bacteria and the form or forms of nitrogen assimilated by the plant from the nodule remain unknown.

From 20 to 100 gm. of soy bean nodules, collected in the field at the flowering and during the fruiting of the plant, did not contain the cyanid radical according to a method which is delicate to 0.01 mg. of hydrocyanic acid.

Differences appeared in the amount and solubility of nitrogen in nodules from different varieties of soy beans obtained from different fields, fertile and infertile, and in different years, but collected at approximately the same stage of growth.

A study of the kinds and amounts of soluble protein in nodules showed no globulin and little albumin, about 3 per cent of the water-soluble nitrogen being in the form of protein and proteose. Of the protein-free soluble nitrogen in the nodules about 16 per cent of the water-soluble form was present as primary amino nitrogen and 19.3 per cent as amid nitrogen. Over 60 per cent of the total water-soluble nitrogen was precipitated by phosphotungstic acid. The amount of the latter form, based upon the percentage of total soluble nitrogen, was much larger in the nodules than in the roots, tops, or leaves.

An increase in the supply of nitrogen, either from nitrates or nodules, caused an increase in amino and amid nitrogen in the plant, but this increase was independent of the form of nitrogen supplied.

Note on the formation of hydrocyanic acid in plants, P. MENAUL (*Jour. Biol. Chem.*, 46 (1921), No. 2, p. 297).—In order to test the hypothesis that HCN is formed in plants by the action of formaldehyde on nitrates, tests were made as described. It was found that in flasks made alkaline to phenolphthalein with sodium carbonate no HCN was formed; in flasks made alkaline to methyl

orange but acid to phenolphthalein a trace of acid appeared; and in flasks made acid to methyl orange, stoppered and placed in the sunlight for one month, 6 mg. of HCN was produced. These results, when considered in connection with the fact that the sap of the plant is slightly acid and that nitrates and formaldehydes are present, are held to indicate that HCN may be formed in plants by the action of formaldehyde on nitrates.

Suberin and cutin, J. H. PRIESTLEY (*New Phytol.*, 20 (1921), No. 1, pp. 17-29).—This is an attempt to define and delimit suberin and cutin and to explain variation in each (as found in various plants), due to different organic acids and the properties thereof, or to different conditions under which such acids have been transformed into modifications found to be present in the mature aggregates.

Thick-walled root hairs of Gleditsia and related genera, W. B. McDOUGALL (*Amer. Jour. Bot.*, 8 (1921), No. 3, pp. 171-175, figs. 3).—The root hairs of *G. triacanthos* became thick-walled and brown within a few days after their appearance. This occurs regularly in all habitats. The thick-walled root hairs persist as long as does the root epidermis, even for several months, unless they are broken off by root movements in the soil. Root hairs of *Gymnocladus dioica* and *Cercis canadensis* sometimes become thick-walled and brown.

Thick-walled root hairs are considered as xerophytic structures and are believed to be relics of a time when the species grew under xerophytic conditions. Trees having thick-walled root hairs possess neither bacterial nodules nor mycorrhizas. This is thought to be due to the inability of the parasitic organisms to enter the roots through root hairs having thickened walls.

Suggestions with respect to the measurement of osmotic pressure, L. KNUDSON and S. GINSBURG (*Amer. Jour. Bot.*, 8 (1921), No. 3, pp. 164-170, fig. 1).—In 1916 the authors began work comparing the plasmolytic and the cryoscopic method. This work is still incomplete, but it is considered desirable to publish the methods for expressing sap and the relations between pressure and concentration, this paper being concerned chiefly with the effect of the temperature at which the tissue is frozen and of the pressure applied on the freezing point of expressed sap. The paper includes also data on the osmotic pressure as determined by the plasmolytic and the cryoscopic method, a special apparatus being described for use in expressing sap and suggestions being made for applying pressures of known values for this purpose.

For reasons indicated, *Zebrina pendula* and *Iresine herbstii* were chosen for this work. The plasmolytic determinations employed CaCl_2 and sucrose.

A piston cylinder apparatus is described for use in the expression of the cell sap, and recommendation is made with respect to the use of standard materials-testing machinery where definite pressures are available.

It was found that a pressure of 50,000 lbs. yields a more concentrated sap than does 10,000 lbs. No great differences were found in the concentration of the sap expressed from leaves whether frozen with liquid air or with an ice-salt mixture, though considerable differences were observed between osmotic pressures as determined by plasmolytic and those by cryoscopic methods.

Variations in the osmotic concentration of the guard cells during the opening and closing of stomata, R. G. WIGGANS (*Amer. Jour. Bot.*, 8 (1921), No. 1, pp. 30-40, figs. 7).—Studies on the characters and behavior of pigmented subfoliar cells of *Cyclamen*, *Iresine*, *Zebrina pendula*, and young beet subjected to CaCl_2 solutions ranging from 0.06 to 1.0 molecular are stated to show that a difference exists between the osmotic concentration of the guard cells of the stomata and that of the other epidermal cells when the stomata are open, also that the osmotic concentration in the guard cells increases in the forenoon and decreases in the afternoon, approaching that of the epidermal cells,

which show but little change during the day as regards osmotic concentration.

The effect of cloudiness on the oxygen content of water and its significance in cranberry culture, H. F. BERGMAN (*Amer. Jour. Bot.*, 8 (1921), No. 1, pp. 50-58, figs. 3).—Investigation carried on during 1918 and 1919 in the cranberry regions of Massachusetts and of Wisconsin showed the effect of cloudiness on the oxygen and the carbon dioxid content of the bog water to be indirect, resulting from the action of light on submerged vegetation. The effect of shading submerged cranberry vines was due to the resulting reduction in the oxygen content of the water. Pond water and bog ditch water showed no essential difference as regards the amount of injury. The greater injury done to the blooms and growing tips of shoots in water deficient in oxygen is due, supposedly, to their higher respiratory rate as compared with that of the older shoots. Cloudiness increases the tendency to injury from submergence of cranberries in bog water.

FIELD CROPS.

The genetic nature of winter and spring varieties of plants, N. I. VAVILOV and E. S. KUZNETSOVA (*O Geneticheskoi Prirode Ozimnykh i Iarovykh Rastenii. Saratov, 1921, pp. 25, pl. 1, figs. 2; reprint from Izv. Agron. Fakult. Saratovsk. Univ., 1921, No. 1*).—The authors crossed the spring wheat *Triticum vulgare lutescens* with a winter variety *T. compactum wernerianum*, and found the spring character to be clearly dominant instead of recessive as in Tschermak's experiments with other varieties. Of 552 F₂ plants, 52 were typical winter and 500 early or late spring forms. Of the 500 F₂ families grown from the 500 spring forms, 234 proved to be constant spring, 36 gave only late spring plants, and 266 segregated into spring plants and winter plants totaling 9,551 and 2,191, respectively. These numerical relations could not be explained by the usual Mendelian ratios.

Some F₂ plants were characterized by a lesser tillering capacity in comparison with the parents. The spring parent averaged five stems per plant, while these F₂ possessed from one to two stems and gave rise to F₃ families composed of one to two stemmed plants marked by leaves but one-half the parental width, by slender straw, and by small stature. Tillering was evidently highly correlated with the length of growth period, as the later the F₂ and F₃ plants were, the greater was their tillering. The behavior of these crosses is held to show a complex genetic difference between winter and spring varieties, and to indicate that the latter can not be regarded simply as loss-mutants of winter races.

Crossing a Persian spring barley *Hordeum distichon persicum eriwanense* with a North Russian spring variety *H. vulgare pallidum jarenskianum* gave rise in the F₂ to 47 distinct spring forms, 2 intermediates, and 10 typical winter forms not producing culms the first year. Of 86 F₂ plants grown from *H. vulgare pallidum aestivum* × *H. distichon zeocriton*, 7 were winter forms. In other crosses of spring barleys, F₃ families with as narrow a ratio as 3 spring plants to 1 winter plant were found. These data are cited to prove that in some cases winter races may be obtained as a result of crosses of spring races, i. e., the progenitors of winter races also could have been spring races.

While the fact that the so-called "wild progenitors" of cereals are all winter plants favors the opinion that winter races are more primitive and have served as progenitors of spring races, a closer investigation reveals the existence of spring varieties among the wild plants. "Spring races in natural conditions have originated as a result of hybridization of different varieties of

winter plants, and vice versa, spring varieties could give origin to winter varieties. Both kinds of plants can be obtained synthetically one from another. . . . Man has not changed winter and perennial varieties by culture into spring varieties, but he selected, consciously or unconsciously, spring races out of a mixture of spring and winter plants, by which most wild herbaceous plants are naturally represented, and multiplied them."

[Report of field crops work in Hawaii, 1920], W. MACFARLANE, H. L. CHUNG, and F. G. KRAUSS (*Hawaii Sta. Rpt. 1920*, pp. 26-32, 37, 42, 56-60, 61, 62, pls. 4).—Cultural, fertilizer, and varietal trials, breeding work, and distribution of planting stocks of new varieties, are described in continuation of previous work (E. S. R., 44, p. 29).

The use of 20 tons of manure per acre on edible cannas gave an average increase of 2.76 tons of tubers at the main station. Guam-grown seed of Guam corn produced 9.4 bu. per acre as compared with 22.9 bu. of Hawaii-grown seed. Although neither was sprayed, Netted Gem, Nos. 1320 and 1322, Irish potato selections under tests for blight resistance yielded 80 and 60 bu. per acre, respectively. Merker grass and Napier grass continue as the best grasses for green feed for live stock. *Panicum antidotale* from the Florida Station yielded at the rate of 11.89 tons of green feed per acre in 8 months without irrigation. Limited varietal trials with cassava, sweet potatoes, grasses, and grain sorghums, and tests of cowpea and garden bean selections are noted, together with a list of the crops found adapted to conditions at Castner. Current methods of rice culture are outlined briefly.

Pigeon pea, Uba cane, cassava, and edible canna proved very drought resistant at the Haiku (Maui) Substation. The wider development of the corn area and increased acre yields are held chiefly due to the introduction of improved varieties and strains and the extensive use of more and better suited commercial fertilizers. In variety-fertilizer tests in cooperation with the Bureau of Plant Industry, U. S. D. A., a substantial increase was generally derived from the use of fertilizers, the increase being fairly proportionate to the amount of phosphates used. Altitude, adapted varieties, and appropriate fertilizing are considered important factors in corn production. Other crop varieties considered worthy of note include Yamata No. 4, a Hamakua hybrid potato possessing improved physical, culinary, and blight-resistant qualities, Wiebke cassava, *Dioscorea sativa* and *D. japonica*, Biloxi soy beans, Napier grass, and Merker grass.

Dependable Michigan crop varieties, J. F. Cox (*Michigan Sta. Spec. Bul. 109* (1921), pp. 3-19, figs. 10).—The work of the station in testing and developing varieties of field crops and their increase under inspection by the Michigan Crop Improvement Association are outlined, with brief descriptions of the varieties of corn, oats, wheat, barley, rye, alfalfa, beans, soy beans, clover, sweet clover, vetch, and buckwheat considered best for Michigan.

[Field crops experiments in England], C. CROWTHER (*Olympia Agr. Co. Ltd., Research Dept. Ann. Rpt., 1* (1921), pp. 20-55, pls. 2).—The experiments reported were conducted on the estates of the Olympia Agricultural Company in various parts of England, and include variety trials with barley, oats, wheat, and potatoes; breeding work with barley, oats, wheat, field beans, flax, Italian rye grass, red clover, and potatoes; and fertilizer and seeding tests with potatoes. Detailed analyses of the whole grain, kernels, and husks of each of the oat varieties tested are tabulated.

Yields obtained by harvesting two $\frac{1}{20}$ -acre sections of a plat of a potato variety varied by about 2 per cent from those secured through harvesting the whole (one-half acre) plat. When part of the produce of each plat was dried, riddled, and reweighed to eliminate the source of error due to the earth ad-

hering to the tubers, smooth skinned, shallow-eyed varieties sustained a shrinkage of 4 per cent, while rough skinned, deep-eyed varieties lost 8 per cent.

[**Report of field crops work in Punjab, India**], D. MILNE ET AL. (*Punjab Dept. Agr. Rpt. 1920, pt. 2, pp. 1-4, 6-51, 52-57, 58, 59, 62-76, 77-81, 82-89, 91-95, 97-117, 119-127, 130-149, pt. 1, figs. 2*).—In continuation of similar work (E. S. R., 44, p. 633), detailed results are given of cultural, variety, fertilizer, and irrigation tests with wheat, corn, gram, cotton, sugar cane, and miscellaneous cereal, forage, and fiber crops, together with milling and baking tests with wheat, for the year ended June 30, 1920.

[**Field crops work in Travancore, India, 1919-20**], N. K. PILLAI (*Travancore Dept. Agr. and Fisheries Rpt. 1919-20, pp. 4-10, 14-17, 37-39, 41*).—The continuation of variety and fertilizer tests with rice, sugar cane, and cassava; breeding work with rice; and seeding trials with cassava, is described as heretofore (E. S. R., 44, p. 433).

[**Report of field crops work in Uganda, 1919-20**], S. SIMPSON ET AL. (*Uganda Dept. Agr. Ann. Rpts. 1919-20, pp. 6-9, 20, 21, 22, 30-34, 51-54; 1920, pp. 19-23, 48-51*).—These pages describe the continuation of work with field crops along the same general lines as noted previously (E. S. R., 45, p. 340).

Observations on seed color in red clover and its inheritance, H. WITTE (*Sveriges Utsädesför. Tidskr., 31 (1921), No. 6, pp. 257-265*).—The occurrence of seeds white or grayish white in color, not heretofore reported, was observed. The white seed color seemed to be associated constantly with white blossoms and with a lack of anthocyanin in the calyx teeth and other vegetative parts, and is regarded consequently as representing an albino type. This character was found to be recessive. Crosses between individuals of the type resulted in a progeny uniform in this particular character. The common yellow seed color was dominant in relation to the white, and in the F_2 a monohybrid segregation seemed to take place. Individual plants with white or nearly white blossoms and yellow seeds were found to be not uncommon, but these always contained anthocyanin at least in the calyx teeth and by crossing such individuals other colors of blossoms and seeds could be segregated.

Little known clovers need more tests (*Seed World, 11 (1922), No. 1, p. 24*).—The habitat and characteristics of strawberry clover (*Trifolium fragiferum*) and subterranean clover are briefly described, with notes on trials of these varieties in the United States.

The inheritance of salmon silk color in maize, E. G. ANDERSON (*New York Cornell Sta. Mem. 48 (1921), pp. 539-554, pls. 4*).—Studies of the interrelations of salmon, green and brown silks, and the relation of salmon silks to other characters of maize are described. See also an earlier note by Emerson (E. S. R., 45, p. 533).

Salmon and brown silks are recessive to green silks by a single factor pair, *Sm sm*. This factor, *Sm*, is independent in inheritance from *P* (pericarp), *A* (aleurone and plant color), *B* (plant color), and *R* (aleurone, plant color, cherry pericarp, and red silk color), but is linked with the factor *Pl* (plant color), and consequently also with *Y* (yellow endosperm). Dominant *A* is necessary to produce salmon or brown silk color. The intensity of pigmentation of salmon-brown silks is directly related to the intensity of pigmentation of the pericarp. The relation of the factors *A*, *Sm*, and *P* to silk color can be represented as follows: *ASmP*, *ASmp*, *aSmP*, *aSmp*, *asmP*, or *asmp*=Green; *ASmP*=Salmon; and *ASmp*=Brown.

The factor *Sm* for salmon silk color is shown to be linked with the factor *Y* for yellow endosperm and the factor *Pl* for plant and anther color, the relative order of the three factors being *Y-Pl-Sm*. The amount of crossing-over is

reported to be about 30 per cent between *Y* and *Pl*, and about 10 per cent between *Pl* and *Sm*. The observed coincidence of crossing-over in the two regions *Y-Pl* and *Pl-Sm* was about 0.4.

Cotton culture in Argentina, C. D. GIROLA (*Am. Soc. Rural Argentina*, 55 (1921), No. 11, pp. 391-403, fig. 1).—Besides notes on cotton culture in the Republic, details of a cotton-growing contest (E. S. R., 43, p. 436) conducted in 1919-20 are given. The principal varieties grown in Argentina are Chaco, Texas Wood, Dixon, Simpkins, and Russell. Where grown on a field scale, yields ranged from 641 to 1,869 lbs. per acre, and the lint graded about good middling.

Cotton production and distribution, season of 1920-21 ([U. S.] *Bur. of the Census Bul.* 147 (1921), pp. 138, figs. 21).—Detailed tabulated statistics similar to those noted heretofore (E. S. R., 44, p. 829) are presented for the season of 1920-21.

Determination of the different technological qualities of cotton fibers, F. HEIM and O. ROEHRICH (*Bul. Agence Gen. Colon. [France]*, 14 (1921), No. 166, pp. 749-773, figs. 4).—Methods are given for determining the length, diameter, maturity, tenacity, and elasticity of the fibers of cotton, with remarks on the graphic expression of numerical results and on classing cotton.

Reginned and cleaned cotton: Results obtained from some spinning tests, W. R. MEADOWS and W. G. BLAIR (*Cotton*, 86 (1922), No. 3, p. 155).—Manufacturing tests of $\frac{7}{8}$ -in. cotton of low grade were conducted by the Bureau of Markets and Crop Estimates, U. S. D. A., in cooperation with the North Carolina State College of Agriculture. Three lots of material, including a mixture of cotton before being reginned or cleaned, the cotton after reginning or cleaning, and an untreated bale equaling the reginned or cleaned cotton in grade, were used in each test.

Cotton grading below good ordinary was cleaned by a continuous passage through several machines commonly used in cotton mills, and then graded strict low middling. The tests showed the percentage of visible waste in the original cotton to be 13.58, in the cleaned cotton 7.73, and in the untreated matched bale 6.9 per cent. The cleaned cotton produced yarn averaging 5 per cent weaker than the original, but 17.1 per cent stronger than the matched bale. This weakness of the latter is thought probably due to the character of the lint in the bale selected.

A mixture from bales grading strict good ordinary and good ordinary was reginned in gins with the grids or ribs and breasts removed, the cotton being fed to the saws through feed rolls adjustable for various lengths of staple and the lint removed from the saws by an air blast. The cotton then graded strict low middling. The percentage of total visible waste was 9.98 on the original, 6.98 on the reginned, and 7.94 on the matched. The reginned cotton produced yarn averaging 5.88 per cent stronger than the original, but 14.4 per cent weaker than that from the matched bale. The character of the cotton in the matched bale perhaps was related to the greater breaking strength of the yarn produced therefrom.

A mixture of cotton from bales grading strict low middling and middling was reginned similarly to the above except that the lint was removed from the saws by a brush instead of an air blast, and graded strict middling after reginning. The total visible waste on the original cotton was 6.63 per cent, on the reginned 5.18 per cent, and on the matched bale 8.43 per cent. The reginned cotton produced yarns 1.52 per cent weaker than the original and 0.21 per cent weaker than the matched bale. The authors state that the visible waste and yarn strength results indicate that definite conclusions can not be drawn from these tests, which should not be regarded as final.

Svalöf Odal oats, Å. ÅKERMAN (*Sveriges Utsädesför. Tidskr.*, 31 (1921), No. 6, pp. 244-256, fig. 1).—A description is given of Svalöf Odal oats, a new early white variety derived from crossing the Guldregn and Improved Dala oats and adapted to northern Sweden, and the results of cooperative tests with the parent varieties and other sorts and crossbred strains in different sections of the country are reported and discussed.

The records of these experiments are interpreted as indicating that the object sought, a variety having the good qualities of Guldregn coupled with increased earliness, was attained in general, but it is pointed out that under the conditions of soil and climate in southern Sweden, where earliness is not such an important factor, Odal oats can not compete with Guldregn. It was only where earliness was of special importance that Odal was found superior to the two parent varieties.

Oleaginous products and vegetable oils, I. GRINENCO, G. CAPONE, and M. COSTA (*Produits Oléagineux et Huiles Végétales. Rome: Inst. Internatl. Agr., Serv. Statist. Gén.*, 1921, pp. XXXII+443).—A statistical study of the production and commercial movement of oil seeds and their products in the different political divisions of the world. Data are given and discussed for each country and summarized for the individual crops. The tabulated statistics embrace the seed and derivative oils of cotton, flax, hemp, colza, rape, mustard, poppy, peanuts, sesame, soy beans, castor beans, coconuts, and palm kernels; copra and miscellaneous seeds and fruits; and corn and olive oils.

Scientific research in potato culture under official supervision, H. M. QUANJER (*Dept. Landb., Nijv. en Handel [Netherlands], Verslag. en Meded. Dir. Landb. No. 1*, (1921), pp. 7-25).—The author outlines the activities of governmental and technical organizations in Europe, the United States, Canada, Japan, and the Dutch colonies in conducting variety trials and nomenclature, cultural and fertilizer tests, breeding work, disease control, and seed certification with potatoes.

The potato crop.—With special reference to new varieties and immunity to wart disease, R. W. WHELDON (*Jour. Newcastle Farmers' Club*, 1920, pp. 47-59).—A brief account of cultural, harvesting, and storage practices with potatoes in northern England, with descriptions, immunity notes, and synonyms of varieties commonly grown in Northumberland, Durham, Cumberland, and Westmoreland Counties.

Studies in rice, K. V. JOSHI (*Poona Agr. Col. Mag.*, 12 (1920), No. 1, pp. 4-12).—Observations are reported on the influence of seed preparation, seeding methods, and soil conditions on rice intended for transplanting, together with a description of the growth of rice seedlings.

Where sprouted seed was submerged, the plants survived but developed thin, tall, and weak, while with shallow applications they were shorter and sturdier and with a broader leaf. Seed planted 0.5 to 1, 3, and 4 in. in depth required 117 to 120, 140 to 150, and 170 hours, respectively, for emergence of shoots. Seedlings from depths greater than 1 in. were weaker and easily broken in uprooting for transplanting.

Cultural experiments with grain sorghums in the Texas Panhandle, B. E. ROTHGEB (*U. S. Dept. Agr. Bul.* 976 (1922), pp. 43, figs. 11).—The detailed results from date- and rate-of-seeding experiments with grain sorghums conducted at Amarillo from 1914 to 1919, inclusive, are reported, supplementing earlier varietal experiments with grain sorghums at the same station (E. S. R., 39, p. 838). Environing conditions and the physical factors influencing crop production at the Amarillo Cereal Field Station are described at some length, together with considerable meteorological and agronomic and yield data on the varieties used in the tests.

The yields were so influenced by seasonal conditions that no one date of seeding is held best for all years, the average yield in a series of years being considered the one safe basis for practice. Dwarf milo produced its best average yields when seeded normally, about May 23; Dawn kafir from the early date, May 10; and feterita and Manchu kaoliang from the late date, about June 10.

In the 6-year period Dwarf milo, in rows 3.5 ft. apart, made the highest average acre yield, 30.8 bu., with 12 in. of row space per plant, while in rows 7 ft. apart the highest average yield, 33.2 bu., was made by plants from 8 to 12 in. apart in the row. The 7-ft. rows with plants 6 in. apart averaged 32.8 bu., practically the same as obtained from the 8 to 12 in. spacing. Spacing the rows 7 ft. apart is considered a slightly surer way to grow a grain crop than spacing them 3.5 ft. apart, but the latter method will produce a higher average total crop yield. Dawn kafir produced its highest average yields, 23.2 bu., from plants with 15 to 19 in. of row space in 3.5-ft. rows, and 23.9 bu. from plants with 4 to 5 in. of row space where the rows were spaced 7 ft. apart.

Dwarf milo seed grown at Arlington, Va., produced crops at Amarillo equaling home-grown seed in yield and otherwise. Arlington-grown feterita and Dawn kafir seed averaged 4 bu. and 2.6 bu., respectively, more than home-grown seed at Amarillo in the 6-year period. Yields secured in all the experiments indicate Dwarf milo to be by far the better variety to grow under the conditions at Amarillo.

When Dwarf milo, feterita, and Dawn kafir were grown for several years at Arlington, Va., Amarillo, Tex., and Chico, Calif., from seed produced at each of the three points, it was demonstrated that the source of seed was practically without influence on the growth of the crop and on yield. Analyses of samples from these crops revealed that environmental conditions, such as soil and climate, affected the chemical composition of the grain much more than did the sources of the seed.

The influence of fertilizers and spacing on the yield and composition of sugar beets, GERLACH (*Bl. Zuckerrübenbau*, 28 (1921), No. 11-12, pp. 123-136).—Applications of artificial fertilizers to sugar beets on light loamy-sand, humus-sandy-loam poor in lime, and loess-loam soils had but little effect on the composition of the beets, while the use of stable manure, green manures, and lime gave favorable results. Lack of potash in the soil resulted in poor yields and beets poor in sugar. The proper use of nitrogenous and potassic salts did not inhibit sugar fabrication in the beets.

Increasing the spacing from the customary 15 by 18 cm. to 40 by 47 to 48 cm. in order to facilitate machine cultivation is considered a harmful practice, depressing both the yield and sugar content of the beets. A spacing of 40 by 25-30 cm. (15.6 by 9.7 to 11.7 in.) is suggested as the most practicable.

The sale of beet seed, H. SAGNIER (*Jour. Agr. Prat.*, n. ser., 35 (1921), No. 45, pp. 387, 388).—The regulations as adopted by the Union Syndicale of Grain and Seed Growers of northern France (Lille) stipulate that beet seed may normally contain as much as 4 per cent of impurities; seed containing up to 6 per cent is receivable, but with a proportional deduction for the amount over 4 per cent. The normal moisture content is 15 per cent, but seed with as much as 17 per cent may be receivable with a deduction for the amount over 15 per cent. Small seed, weighing less than 22 gm. per 1,000, should germinate 70 per cent, medium seed, 22 to 25 gm. per 1,000, 75 per cent, and large seed, over 25 gm. per 1,000, 80 per cent. When the difference between the test results and the standard is not over 5 per cent, the merchandise is receivable but with

a corresponding reduction. After six days four-fifths of the germs should be emerged.

Tests of nitrogenous fertilizers with tobacco, E. BLANCK and F. PREISS (*Fühling's Landw. Ztg.*, 69 (1920), No. 21-22, pp. 416-426, fig. 1).—Ammonium sulphate, urea, and stable manure with urea were applied six days before setting out plants of Virginia tobacco, but lack of soil uniformity rendered yield differences of doubtful value. In the burning tests, leaf from the plats receiving ammonium sulphate exhibited the longest fire-holding capacity, and the tobacco from the plats fertilized with stable manure plus urea the shortest, while the unfertilized plats and those treated with urea alone were apparently intermediate in this respect. The mildest flavor and most agreeable aroma in the uncured leaf was found in tobacco fertilized by urea and by ammonium sulphate, while the leaves from the plats treated with stable manure had a rather pungent odor and a biting taste.

Pusa 12 and Pusa 4 in the Central Circle of the United Provinces, B. C. BURT and A. and G. L. C. HOWARD (*Agr. Research Inst. Pusa Bul.* 122 (1921), pp. 34, pl. 1).—This paper gives the characteristics of Pusa 12 and Pusa 4 wheat, relates the methods followed in replacing the local crop with these strains, and reports the results of milling and baking tests in India (E. S. R., 26, p. 135; 33, p. 361), Great Britain, and Australia.

Pusa 12 is described as beardless, with a shining red chaff, tall, bright, strong straw and large white seed. Pusa 4 is a strong-strawed, beardless variety with bluish-green foliage, white felted chaff, and large, translucent white grain. Both sorts are easily distinguished in the field. It is estimated that approximately 250,000 acres in the Province were under these varieties in 1918. On the basis of milling and baking tests, A. E. Humphries considers that Pusa 4 and Pusa 12 are much superior to the ordinary grades of Indian wheat, such as Choice White Karachi.

Wheat production in Peru, 1919, J. S. SANTISTEBAN (*Min. Fomento, Dir. Agr. y Ganaderia [Peru], Estadis. Indus. Triguera*, 1919, pp. 103).—Statistical information relative to the wheat industry in Peru, supplementing the data noted previously (E. S. R., 44, p. 530), is presented for the year 1919.

Pastures in our wheat-growing districts: The displacement of native grasses by introduced herbage, E. BREAKWELL (*Agr. Gaz. N. S. Wales*, 32 (1921), Nos. 10, pp. 685-691, figs. 2; 11, pp. 767-773, figs. 2; 12, pp. 857-865, figs. 2).—Many of the native grasses formerly occupying large areas of the present wheat-growing districts of New South Wales have practically disappeared. With the exception of *Chloris truncata*, those on the loose alluvial or basaltic soils were largely replaced by short-lived spring annuals which die with the advent of summer conditions and leave the soil bare. A study of the plants found in different wheat-growing centers showed the introduced herbage to depend upon soil and climatic conditions.

Burr trefoil does not thrive where the winters are too long, or on the shallow soils of rocky hills, but grows best on the stiff or alluvial soils of the flats. Woolly trefoil (*Medicago minima*) replaces burr trefoil on rocky hills, if the temperature is suitable for both. Barley grass is found during the spring in both the coldest and warmest localities throughout the State, occurring most frequently on old cultivated lands.

Native crowfoot (*Erodium cygnorum*) is adapted to the short warm spring climates rather than to the long winter climates. It often dominates all other herbage on light soils, but is subordinate on stiff black soils. The introduced crowfoots are found under all temperatures, generally partake of a rosette character, and constitute most of the herbage where the mean temperatures of September and October are below 55 and 62° F. respectively.

Variegated thistles (*Carduus marianus*) require for their best development the alluvial or basaltic soils where the black thistle also thrives. Cockspur (*Centaurea melitensis*), star thistle, and slender thistle grow well on light soils. Cape weed (*Cryptostemma calendulacea*) succeeds on old cultivated lands, or in paddocks adjoining cultivated lands. Ball clover appears to depend to a large extent on good winter and spring rainfall.

Rat-tail fescue (*Festuca bromoides*) is equally abundant under cold and warm conditions, but prefers the light to the heavy soils. The introduced brome grasses seem to depend on a moderate spring temperature and on a good rainfall. The *Danthonia* and *Stipa* grasses are the most persistent of all native grasses in the hilly country throughout the State, and where judiciously managed are not being displaced by herbage.

Practically all the summer herbage is found on old cultivated or fallowed lands, excepting wire weed (*Polygonum aviculare*) which encroaches on pastures. The herbage mainly comprises wire weed, prickly lettuce (*Lactuca scariola*), wild melon (*Cucumis myriocarpus*), introduced *Eragrostis* spp., stink grass, barnyard grass, and summer grass (*Panicum sanguinale*). The thick growth of stink grass often crowds out all other summer vegetation. Barnyard grass and summer grass succeed in the moist situations.

Onion grass (*Romulea bulbocodium* [*R. rosea*]), R. A. BLACK (*Tasmania Agr. and Stock Dept. Bul. 93* (1920), pp. 1-7, pl. 1, figs. 2).—A botanical description of the weed is given, with an explanation of the confused nomenclature. See also an earlier note (E. S. R., 13, p. 358).

Analyses show the foliage to be of low feeding value and very indigestible, due to the high percentage of extremely tough fiber. Under cultivation, the plant might be a profitable source of fiber. The corm contains 75.3 per cent of starch on a dry weight basis. Although repeated plowing and cultivation suppresses the weed, rooting up and destroying the plants while in bloom is considered the only safe means of eradication.

Production and germination of twitch grass, W. H. WRIGHT (*Ontario Agr. Col. and Expt. Farm Ann. Rpt.*, 45 (1919), p. 40).—Extensive studies and germination tests showed twitch grass to produce an average of 12.8 seeds per spike, with 89 per cent of the seeds germinating in Zurich germinators and 88.3 per cent in sand. The danger of spreading twitch grass seed in straw, manure, and commercial seed is indicated.

HORTICULTURE.

[**Horticultural investigations**], L. R. DETJEN (*Delaware Sta. Bul. 129* (1921), pp. 15-18).—Without reporting data, brief statements are given of the progress of various experimental activities during the year ended June 30, 1921.

The importance of fertilization to the apple was shown by the fact that control plats in every instance were less productive than those receiving fertilizers; however, the use of excessive amounts of fertilizer did not result in proportionate increases in crop. In variety tests with small fruits, Rathbun and Erie blackberry proved insufficiently hardy to warrant their use for market or home purposes. In the cabbage breeding project, a wide variation was noted among the progeny obtained by selfing the blooms of a single plant. Observations on two strains of the 1919 selection showed one strain to be practically free and the other practically homozygous for the so-called "rosette" character.

[**Horticultural investigations**] (*Oreg. Agr. Col. Bul. 297* (1919), pp. 16, 17).—Without presenting data, brief summations are given of the progress of various

activities. Pruning studies with the apple indicated that June heading increased the number of fruit buds and leaf spurs with little or no decrease in the vitality of the tree.

Depth of planting studies with several species of fruits showed that in general shallow planting is preferable. A strain test of broccoli revealed a wide variation in type and in yielding capacities. The application of commercial fertilizers to poor soil did not result in as satisfactory yields as were obtained upon naturally fertile soils. Irrigation was found to control to a large extent the blossom end rot of tomatoes and to increase the production of late beans.

Report of the horticultural division, J. M. WESTGATE (*Hawaii Sta. Rpt. 1920, pp. 17-26, pl. 1, fig. 1*).—During the year ended June 30, 1920 (E. S. R., 44, p. 44), tests of and demonstrations with various horticultural plants, including the avocado mango, papaya, grape, and Macadamia nut, were continued with a view to determining the better varieties and encouraging their dissemination throughout the islands. A grafting wax consisting of 1 part tallow, 8 parts beeswax, and 4 parts resin proved suitable under the tropical environment. An improvised propagating frame is described and illustrated wherein the soil is kept warm during the night through the medium of water heated by the sun's rays during the day.

Annual report of the experimental work of the Ganeshkhind Botanical Garden (Poona District) for the year 1915-16, W. BURNS (*Bombay Dept. Agr. Ganeshkhind Bot. Gard., Kirkee, Ann. Rpt. Expt. Work, 1915-16, pp. II+44*).—In this progress report (E. S. R., 35, p. 643) data are presented relative to miscellaneous investigations with various tropical and subtropical plants, including the mango, orange, lemon, guava, papaya, fig, and banana.

[**Origin of new fruits**], A. F. ETTER (*Calif. Dept. Agr. Mo. Bul., 10 (1921), No. 9, pp. 492-494*).—In this brief account relative to the author's activities in fruit breeding, there are mentioned the All Gold apple and Calisthene, Ettersburg No. 121, and Tripler strawberries.

Long pruning, J. C. WHITTEN (*Calif. Dept. Agr. Mo. Bul., 10 (1921), No. 10, pp. 545-547*).—In this discussion of the relative merits of long and old style pruning, which consisted in the annual heading back of new shoots, the author, in elucidating the various processes of food assimilation and storage in the apple tree, shows how long pruning favors the maximum development of these nutritional activities and incidentally increases the hardiness and improves the general welfare of the tree.

Experiments with neon light (*Landw. Jahrb., 52 (1919), Ergänzungs. 1, pp. 76-78, fig. 1*).—In studies conducted at the Dahlem Station it was found that tomato and cucumber plants forced during the night and during cloudy days with the light of neon electric lamps gave notably increased yields as compared with control plants grown under normal conditions in the same house. The lighted half of a cucumber house yielded 500 fruits weighing 277 kg. 530 gm., while the control half produced only 370 fruits weighing 186 kg. 600 gm. A repetition of the test, in which neon lamps were placed in that part of the house previously used as control, resulted in similar differences in yield in favor of the artificially forced plants. Even sharper differences were recorded for the tomato crop. The superiority of the neon light over other forms is believed to lie in its fiery red color and in the nature of the rays, which are claimed to be readily absorbed by the chlorophyll of the plants.

Relation of age to productivity in cucumber seed, G. A. LANGER (*Landw. Jahrb., 52 (1919), Ergänzungs. 1, pp. 59, 60*).—A brief report of a test conducted at the Proskau Experiment Station of the relation of age of cucumber

seed to productivity. In comparing 1- and 3-year-old seeds of Weigelt Beste von Allen cucumber, plants from the older seeds fruited 10 days earlier and produced a 50 per cent larger crop.

A note on soil sterilization for tomatoes, T. PARKER, A. W. LONG, and J. S. MITCHELL (*Fruit, Flower, and Veg. Trades' Jour.* [London], 41 (1922), No. 3, pp. 54-56, figs. 5).—In a test of the value of several chemicals for partial sterilization, and incidentally for their effect on the plant, five different treatments were compared—(1) control, (2) dichlorcresol and cresol mixture, (3) dichlorcresol and basic slag, (4) p-toluene sodium sulpho-chloramid, and (5) cresol (emulsified). The average yields per plant for the different treatments were, respectively, 41, 32.5, 36.9, 23.2, and 18.5 oz., the greater yield of the control plat indicating that the chemicals were used at too great a concentration. Dichlorcresol was active in stimulating a greater development of foliage, haulm, and root fibers, and in preventing cankerous and nematode injury. Roots from the several plats are illustrated.

Hydrocyanic acid injury to tomatoes, G. F. POTTER (*Amer. Soc. Hort. Sci. Proc.*, 17 (1920), pp. 120-126).—In this study, conducted at the Wisconsin Experiment Station, various factors involved in the fumigation of plants with hydrocyanic acid gas were carefully studied in their relationship to possible injury. The work was carried on in a paraffin-lined box, using tomatoes grown under like conditions as plant material.

In determining the maximum safe dosage for several different exposure lengths, it was found that injury did not bear a simple relation to the length of exposure, which fact is explained by the assumption that in longer exposures it becomes increasingly difficult for gas to enter the leaf stomata. From data obtained in a study of the effect of relative humidity it was apparent that the dose for a given volume must be reduced under conditions of high humidity. Plants growing in soil dried sufficiently to cause wilt withstood a much stronger dose of gas than did similar plants in moist soils. The influence of temperature was shown by the fact that plants were killed at 86° F., while at 70° the same dose was used repeatedly without injury.

Supplementing the discussion, practical recommendations are given for a greenhouse fumigation.

A new test for maturity of the pear, A. E. MURNEEK (*Oregon Sta. Bul.* 186 (1921), pp. 28, figs. 9).—In this third report on pear harvesting and storage investigations (E. S. R., 42, p. 40), further data are given relative to the use and accuracy of an apparatus designed to test the degree of maturity of pears by recording on a scale the number of pounds required to force a hemispherical plunger a definite distance into the surface layers of the fruit.

Repeated trials with Bartlett pears indicated that harvesting should commence when freshly picked fruits register a resistance of 35 lbs. and should continue for distant shipment until 25 lbs. is reached. To overcome individual variations it is advised that each lot under test comprise 10 to 15 fruits of normal type and comparatively free from blemishes. Russetting and high coloring were found to increase the resistance in the case of Bartlett pears; therefore it is recommended that such fruits be excluded from the test.

The accuracy of the apparatus was proved by its ability to register slight variations in maturity due to difference in site, exposure, soil, and similar environmental factors. Favorable results obtained in tests with Bosc, Howell, Anjou, Comice, and Winter Nelis pears and Grimes and Wagener apples showed the potential possibilities of the machine. The picking season of Bosc, as indicated by the tester, was found to range between 24 and 20 lbs.

Measurements of the increase in size of Bartlett pears showed a close correlation between increase in transverse diameter and increase in weight. Average seven-day increments were found to be 5.1 per cent for size and 17.7 per cent for weight, an approximate ratio of 1:3.5. The author believes, however, that the pressure test is the most reliable index to the exact stage of maturity of the fruits.

[Changes in chemical composition of peaches], L. W. TARR (*Delaware Sta. Bul.* 129 (1921), pp. 11, 12).—The results of one year's study of the chemical composition of peaches from plats treated with varying amounts and combinations of fertilizer elements showed that in the early stages of development starch and reducing sugars were present, with no sucrose. With the approach of maturity the reducing sugars became almost constant at 2.25 to 2.75 per cent, while cane sugar increased steadily and starch became very low. The earliest and best fruits were obtained from the check plats.

Small fruit, G. M. DARROW (*N. Y. State Hort. Soc. Proc.*, 1921, pp. 90-98).—The status of small fruit production throughout the United States is briefly discussed with reference to investigational activities, improved commercial practices, and promising new varieties.

[Stocks for American grapes], F. E. GLADWIN (*N. Y. State Hort. Soc. Proc.*, 1921, pp. 86, 87).—The author briefly observes that further records (E. S. R., 28, p. 640) upon the yield of grape varieties grafted on resistant stocks indicate that Concord on Riparia Gloire is more fruitful than when on its own roots. Less important gains in yield were recorded for Concord on St. George stock.

Grape culture in Greece, P. VIALA (*Ann. Inst. Natl. Agron.*, 2. ser., 15 (1921), pp. 5-84).—This is a report of an investigation of the grape-growing industry of Greece, conducted by a French commission at the request of the Greek Government, which had become alarmed by the phylloxera invasion of Macedonia and other neighboring areas. The author believes that the absence of this dreaded insect from Greece proper is due to chance, and that despite quarantines it is only a question of time when the phylloxera will gain an entrance. In anticipation of this event, the different soil types in important grape-growing sections of Greece were studied with reference to their suitability for particular varieties of resistant stocks. In a similar manner stocks are recommended for various types of vineyard soils, previously analyzed in connection with surveys conducted under the direction of the laboratory of agricultural chemistry at Athens.

A proposed treatment for frosted grapevines, R. L. NOUGARET (*Calif. Dept. Agr. Mo. Bul.*, 10 (1921), No. 9, pp. 345-358, figs. 12).—Following severe frosts in the spring of 1921, an investigation was conducted in the San Joaquin Valley, Calif., to determine the best methods of treating injured vines. In observations made upon the recuperative powers of 11 varieties of *Vitis vinifera* it was found that the side growths arising from the leaf axis buds of injured shoots were always sterile, whereas, with the exception of Thompson Seedless, if the frosted shoots were broken off at the base fruitful shoots were almost invariably forced from dormant buds. The partial cutting back of frosted shoots proved useless in that as a result the leaf axis buds put forth barren shoots, while the dormant basal buds remained inactive. Breaking off the injured shoots proved to be the most effective treatment and was found to result in less bleeding than did cutting. The several varieties included in the study are classified according to their manner of recuperation.

Some phases of the problem of the decline of old citrus orchards, A. D. SHAMEL (*Calif. Dept. Agr. Mo. Bul.*, 10 (1921), No. 10, pp. 521-528).—Various

causes which may lead to the premature decadence of citrus orchards in California are briefly discussed, with suggestions for improvement.

The pollination of coconut, V. C. ALDABA (*Philippine Agr.*, 10 (1921), No. 5, pp. 195-207, pl. 1).—A report of a study conducted at the College of Agriculture, Los Baños, P. I., in which detailed technical observations were made upon the structure of the coconut flower and the process of pollination. In addition, pollen was tested for percentage and duration of viability and manner of growth in several different strength sugar solutions.

It was found that unfertilized female blossoms do not produce nuts, and that crossing between flowers of a single tree or of different trees is the normal process of fertilization. Either insects or wind may serve as active agents in pollination. The majority of staminate flowers in a single cluster begin to open about 6 a. m. and shed pollen about 8 a. m. Pistillate blossoms were recorded as receptive after two or three weeks from the time of the first appearance of the inflorescence. The best growth of pollen occurred in 25 and 30 per cent sugar solutions. Pollen was found to remain viable from 2 to 9 days after dehiscence.

Pineapple experiments [Haiku Substation], F. G. KRAUSS (*Hawaii Sta. Rpt.* 1920, pp. 43-56).—The results obtained in miscellaneous cultural investigations with the pineapple are reported with data.

In comparing the effect of burned lime applied 30 days before and immediately preceding planting, the earlier application proved more satisfactory, the second apparently exerting a harmful influence. In a test of the comparative value of several forms of lime applied in different ways and amounts, hydrated lime broadcasted after plowing at the rate of 3,000 lbs. per acre proved peculiarly effective, increasing the yield approximately 6,068 lbs. per acre. Burned lime proved less valuable than hydrated, and ground limestone and coral sand had little effect. The negligible and in some instances negative influences of these materials, when placed in the furrow directly beneath the plants, was believed to be due to a too great concentration near the roots. The results of a similar test with several phosphatic materials indicated differences in yield too insignificant to allow for any definite deductions.

In plowing under various forms of vegetable matter, including corn cobs, corn stalks, green vines, and pineapple residue, it was found that the corn by-products were of no appreciable value, probably due to extended droughts during the growing season. Substantial gains were noted on plats underlaid with green vegetable materials. The removal of the residue of a previous crop of pineapples caused a sharp decrease in yield below that of a similar plat in which these materials had been turned under. A study of the effect of dynamiting and various depths of plowing showed little or no response from the different treatments. In a test of methods of preparing for planting, an increased yield was obtained from the use of unseasoned slips, an unusual occurrence accounted for by the dry weather prevailing during the planting season. The stripping of the lower basal scales proved advantageous in terms of increased yield. Flat culture gave better results than ridge and other forms. No detrimental influence was apparent on lands cleared by burning. The application of dried blood to the crowns was observed to exert a temporary stimulation on freshly set and backward plants. Pineapples grown on sugar-cane land from which all residue had been removed did not grow satisfactorily. Guava lands were usually found suitable for pineapple culture. Any soil exceeding 20 in. in depth and underlaid with loose porous rock is recommended as satisfactory for pineapple growing.

FORESTRY.

Five new species of Cedrela, S. F. BLAKE (*Biol. Soc. Wash. Proc.*, 33 (1920), pp. 107-111).—Technical descriptions are given of the tree, foliage, and flowering parts of five newly determined species of Spanish cedar, *C. discolor*, *C. rosei*, *C. rotunda*, *C. whitfordii*, and *C. yucatan*, natives of tropical America.

On the cause of the darkening of the heartwood of Cryptomeria japonica, M. FUJIOKA and K. TAKAHASHI (*Jour. Forestry*, 19 (1921), No. 8, pp. 844-866, fig. 1).—In an investigation of the cause of dark-colored heartwood in certain trees of *C. japonica*, an important coniferous species of Japan, the author found that this phenomenon is not a hereditary character but is due to chemical changes in the sap. The alkalinity of the sap of such trees was higher than that of normal trees. Furthermore it was found that this dark color could be induced as the result of wounds which in the process of decomposition apparently gave rise to ammonia. As a preventive measure it is recommended that in pruning *C. japonica* particular care be exercised to avoid large wounds, especially in situations such as calcareous and moist soils where these off-type trees are known to occur in greater frequency.

Notes on the Bishop pine (*Pinus muricata*), W. METCALF (*Jour. Forestry*, 19 (1921), No. 8, pp. 886-902, figs. 7).—Miscellaneous studies with the Bishop pine are reported.

Measurements of trees found for the first time in Humboldt County, Calif., 100 miles north of the previously known range, indicated that under favorable environment this species may become a large size tree capable of furnishing a commercial supply of timber. Growth determinations with 30-year-old trees at Inverness showed a mean annual growth of 143 cu. ft. per acre.

In extracting seed from cones, it was found that short periods of heating at 150° to 170° F. were more satisfactory than longer exposures at lower temperatures. Subjection to 200° for a brief period did not apparently reduce the viability of seed. The germinating capacity of seed from young trees was found to be much higher than that of old trees. No apparent relation was established between the length of time that seed had been held in the cones and its viability. Seed from young trees showed a strong negative correlation between age and loss of seedlings from various causes such as damping off, while that from older trees indicated almost as strong a correlation in the opposite direction.

Yellow pine reproduction, W. J. PERRY (*Jour. Forestry*, 19 (1921), No. 6, pp. 622-631).—In addition to a general discussion of various factors involved in yellow pine reproduction, the author reports observations on 10 plats in which various factors were represented. As a result of the study it is concluded that yellow pine reproduction is for the most part dependent upon three factors, arranged in order of importance, (1) seeding, (2) grazing, and (3) brush disposal. Proper seeding may be provided for by sparing a sufficient number of full crowned trees, capable of prompt seed production. Sheep were found to be absolutely harmful, while controlled cattle grazing was apparently beneficial in the suppression of coarse vegetation. Burning is recommended as the most effective means of brush disposal, with piling in compact heaps as second choice.

A study of windfall in the Adirondacks, C. E. BEHRE (*Jour. Forestry*, 19 (1921), No. 6, pp. 632-637).—In this study of the nature of injuries resulting from a windfall which occurred in May, 1916, in the Adirondack Forest near Lake Ne-he-sa-ne, an opportunity was presented for comparing the relative injury to various species, for determining the effect of site, and for comparing the amount of injury in two stands, the first one cut over in 1898, and the second in 1896 and again in 1915.

The principal species of the region are spruce, balsam, yellow birch, hard maple, and beech, the latter three being grouped as hardwoods. In general the damage was greater in the 1915 cutting than in that of 1898. Balsam suffered most severely in both cuttings and in all types of forest on account of its shallow rooted nature and tendency to early decay. The damage to balsam was about equally divided between uprooting and breaking. In spruce the greater amount of injury was from uprooting, while in the hardwoods injury was largely due to breaking. It is concluded that thinning of the character practiced in this area did not materially increase the liability to windfall injury; however, it is recommended that heavy openings be avoided wherever possible as greater injury occurred in such locations.

A study of regeneration on certain cut-over hardwood lands in northern Michigan. P. L. BUTTRICK (*Jour. Forestry*, 19 (1921), No. 8, pp. 872-876).—In a study of the origin and character of forest reproduction in the lower peninsula of Michigan following the cutting of the original forest, data were obtained which led the author to conclude that the few trees remaining after cutting are of little value as seed trees or as potential timber. Basswood was the only mature hardwood tree to sprout from the stump. Younger trees of several species sprouted abundantly, sufficiently in many instances to form the basis for a new forest. A large portion of the original seedlings continued to grow after logging, but those arising subsequent to cutting were subjected to bitter competition with briars and grass. Seven-year old slash was found to be still undecayed and to constitute a serious fire hazard.

What cooperation in forest fire protection means to Georgia. J. G. PETERS (*South. Forestry Cong. Proc.*, 3 (1921), pp. 44-48).—In this address, delivered before the third Southern Forestry Congress, the author emphasizes the importance of protecting young forests and cut-over lands from fire so that natural reproduction may take place. It is urged that Georgia take advantage of the protective provisions of the Weeks Law.

Annual report of the director of forestry of the Philippine Islands for the fiscal year ended December 31, 1920. A. F. FISCHER (*Philippine Bur. Forestry, Ann. Rpt. Dir. Forestry*, 1920, pp. 125).—This report, similar to that of the preceding year (E. S. R., 44, p. 641), contains information pertaining to activities of the various divisions of the Bureau of Forestry, with statistical data appended relative to forest products, revenue, and expenditures.

Annual progress reports of forest administration in the United Provinces for the forest years 1920-1921. H. G. BILLSON and F. F. R. CHANNER (*United Provs. [India] Forest Admin. Ann. Rpts.*, 1919-20, pp. 34+LXXXV+3; 1920-21, pp. 28+LXXIII+3).—These reports for the two periods ended June 30, 1920, and March 31, 1921, contain the usual information relative to forest activities in the United Provinces, including data relative to changes in area, silvicultural operations, forest products, expenditures, and incomes.

Progress report of forest administration in the Province of Assam for the year 1920-21. F. TRAFFORD and H. B. RAU (*Assam Forest Admin. Rpt.*, 1920-21, pp. 15-49).—In this report of activities for the nine months' period ended March 31, 1921, the usual information (E. S. R., 46, p. 238) is presented relative to the management of the State forests in Assam, including data relative to alterations in area, silvicultural operations, forest products, incomes, and expenditures.

DISEASES OF PLANTS.

Report of the department of plant pathology and soil bacteriology. T. F. MANNS and J. F. ADAMS (*Delaware Sta. Bul.* 129 (1921), pp. 18-28).—Progress reports are given on a number of investigations being carried on at the station.

In a study of some biological changes in the soil, the authors investigated the effect of detrimental organisms on the germination of corn and found four diseases which are carried in the seed corn to be the cause of considerable injury. A previous account of some of the data presented has already been noted (E. S. R., 46, p. 239).

Continued studies are being made of the diseases of sweet potato, and experiments have been begun on sick soil areas to establish the effect that fertilizers would have on the disease of sweet potatoes known as pox. Different applications were made of fertilizers, and examinations of the stand of sweet potatoes showed that there was a somewhat better stand on manured plats than on others. In some cases from 50 to 70 per cent of the plants were killed, presumably by this disease. The character and injury by the fungus are described, and it is considered evident that pox is a strong factor in the cause of soil sick conditions, if not the entire cause. Greenhouse studies carried on in conjunction with this investigation are said to indicate that the soil-rot symptoms observed were the results of infectious material or toxic substances present in the soil.

Some further investigations of diseases of peach are briefly reported on, particular attention being given to yellows or little peach disease. Sap and crushed tissues of trees sick with yellows were placed in abrasions of healthy peach trees, but it was not positively established that the disease could be produced by this method. Histological studies were undertaken in connection with peach yellows, and there was found to be no difference in the anatomical condition of the healthy and diseased wood. In the storage products of metabolism, the diseased wood showed a higher starch content and more crystals in the corticular tissue. There was also a gum plugging of the cells in the medullary rays in the diseased wood that was lacking in the healthy wood. Blossom buds on shoots affected by yellows are said to have shown greater maturity and development of the pollen mother cells, and leaves from shoots affected with yellows showed a lack of the products of metabolism. These studies, while quite significant, are not considered sufficiently definite to warrant deductions at this time.

Some observations are reported on diseases of cucurbits, in which certain varieties of cantaloups were found somewhat resistant to leaf blight. Spraying experiments for control of insect and leaf spot diseases showed that dust applications were about as effective as liquid sprays.

Notes are also given on pea root rot and tomato stem rot.

[Notes on plant diseases] (*Oreg. Agr. Col. Bul.* 297 (1919), pp. 18, 19).—Brief notes are given of a number of plant diseases that have been under investigation, and it is stated that Bordeaux mixture, both as to reliability and effectiveness, has proved the most successful treatment for the control of peach leaf curl.

For the control of gooseberry and currant diseases, lime sulphur, dry lime sulphur, sulphur dust, and lead arsenate combination have all given good results.

For the control of the downy mildew of the apple, applications of sulphur dust gave better results than lime sulphur alone, iron sulphid mixture alone, or iron sulphid and lime sulphur combined. In experimental spraying for the control of apple and pear scab, dust spraying was compared with the use of lime sulphur sprays, and the results obtained indicated that dusting with sulphur was nearly if not quite as effective as the usual liquid lime sulphur, but the cost of the dust in the quantity in which it was applied was much greater than the cost of the liquid spray.

The occurrence of bean blight in Oregon is reported.

[**Plant diseases in Barbados**], B. A. BOURNE (*Barbados Dept. Agr. Rpt. 1920-21, pp. 10, 11*).—Sugar cane root disease continues to cause considerable economic loss. It is not certain that *Marasmius sacchari* causes this disease, which may be related to *Rhizoctonia*. *Colletotrichum falcatum* and *Cephalosporium sacchari*, associated with red rot, *Thielaviopsis paradoxa*, causing pineapple disease, *Cercospora vaginæ* causing a leaf sheath red spot, and *Leptosphaeria sacchari* causing a leaf ring spot, were about as prevalent during this year as usual. Cotton (*Gossypium* spp.) showed no severe disease, though mildew and leaf spot were present. Sudan grass (*Holcus sorghum sudanensis*) leaf blotch or scorch was associated with acervuli of *Colletotrichum lineola*, which is considered to be synonymous with *C. graminicolum*. Cassava (*Manihot* sp.) tubers sent in showed the presence of a *Gloeosporium*, apparently a wound parasite. Carrot (*Daucus carota*) showed a leaf tip scorch associated with an organism apparently identical with *Bacillus carotovorus*. Mango (*Mangifera indica*) stems were infected with *Diplodia cacaoicola*, both the *Macrophoma vestita* and the *Fusarium* stage of this fungus being found on diseased material. Inoculation experiments, however, did not reproduce the disease. *D. cacaoicola* was found to attack elder (*Sambucus canadensis*) stems and gardenia twigs and leaves. Date palm (*Phoenix dactylifera*) was heavily infested with *Graphiola phoenicis*. Fern (*Adiantum tenerum*) showing a leaf scorch from the tips back bore a *Pestalozzia*. Palm (*Chrysalidocarpus lutescens*) was found to be suffering from leaf spots associated with *Leptosphaeria* sp. and *Phyllosticta* sp. Flowering Ipomoea vine (*I. horsifalliae*) dropping its inflorescences was found to be attacked by *Rhizopus nigricans*, apparently acting as a wound parasite.

Diseases [of plants in Central America], A. D. LE P. TRENCH (In *Report on Visit to Guatemala and Costa Rica to Investigate Methods of Cultivation of Coffee, and Its Diseases and Pests. Nairobi: Kenya Colony [Africa], Dept. Agr., [1920], pp. 15-17*).—Diseases and pests named as prevalent in Guatemala and Costa Rica are *Stilbum flavidum*, *Pelicularia koleroga*, *Cercospora coffeicola*, *Gloeosporium coffeanum*, the root fungus or stump rot (of old forest trees in coffee plantations, spreading to coffee and infecting the soil), stem disease (*Phothora vastatrix*) in Guatemala and Mexico, thrips (Costa Rica only), and scale insects with sooty mold.

Report of the division of plant pathology, C. W. CARPENTER (*Hawaii Sta. Rpt. 1920, pp. 37-40, pls. 2, fig. 1*).—In continuation of a previous report on root rot diseases (E. S. R., 42, p. 352), in which it was indicated that several root rots of plants were due to a fungus of the *Pythium* type, the author reports inoculation experiments that seem to indicate that the Lahaina disease of sugar cane is caused by a fungus of this type.

An account is given of experiments for the control of taro rot in which the value of drying out and plowing up the land is contrasted with continuous planting without drying out the land. Definite conclusions were impossible from the experiments, but indications are that taro rot could be controlled by drying and plowing and by applying either lime or coral sand some time before replanting to taro.

In continuation of the investigations on the banana freckle disease, due to *Phoma musae* (E. S. R., 44, p. 47), the author reports that through neglect some plants were not properly sprayed and pruned, and that where there was neglect to fertilize and irrigate the plants there was less disease. This was thought to suggest that the use of nitrogenous fertilizers may be a factor predisposing to disease.

Principal diseases of plants in Morocco, E. MIÈGE (*Soc. Path. Veg. France Bul., 8 (1921). No. 1, pp. 37-40*).—In this preliminary note a list is given, with

discussion, of fungus, bacterial, and undetermined diseases of economic plants in Morocco.

Bean anthracnose, M. F. BARRUS (*New York Cornell Sta. Mem.* 42 (1921), pp. 101-215, pls. 5, figs. 35).—A detailed description is given of bean anthracnose due to *Colletotrichum lindemuthianum*. All parts of the plant, even the roots, are said to be subject to the disease, which is most noticeable on the pods where it forms dark, sunken cankers which subsequently extend to the seed contained within. The morphology and physiology of the fungus in relation to the host are described at length, and the results are given of infection studies carried on by the author. There are said to be at least two strains or biologic forms of the fungus, and many varieties of beans which are resistant to one strain are susceptible to the other, and vice versa. Some varieties are said to be very susceptible to both strains of the fungus, and at least one is highly resistant to both. Several other species of *Phaseolus* in addition to *P. vulgaris* are susceptible to anthracnose, and in a few cases cowpea and kulthi and val bean have shown susceptibility.

For the control of the disease the selection of seed from clean pods, or the use of seed grown from western regions where anthracnose does not exist, is recommended. Spraying with Bordeaux mixture throughout the season is said to prevent anthracnose to a large extent. Control by means of resistant varieties is thought to give the greatest promise of satisfactory results.

The yellows disease of cabbage in southwest Virginia, F. D. FROMME (*Virginia Sta. Bul.* 226 (1921), pp. 9, figs. 5).—The disease of cabbage known as yellows is said to be prevalent in the commercial section of southwest Virginia, losses amounting to 25 per cent of the crop in a number of fields, and from 80 to 90 per cent in a few cases being reported. This disease, which is due to *Fusarium congruulinans*, has been under investigation, particularly as to methods of control. Tests were made of several varieties of cabbage grown in comparison with disease-resistant strains developed by the Wisconsin Experiment Station, and as a result of the experiment the author states that yellows can be satisfactorily controlled by the use of resistant varieties of cabbage.

The cabbage grower should also guard against losses from other diseases of cabbage by the adoption of rotations, avoiding other crops belonging to the cabbage family; discouraging the purchase of plants from localities where disease may occur; and the treatment of cabbage seed before planting by soaking 30 minutes in a 1:1,000 corrosive sublimate solution. For the control of clubroot, the application of slaked lime at the rate of about 75 bu. per acre is recommended.

Corn smut and its control, E. M. WILCOX (*Nebr. Corn Improvers' Assoc. Ann. Rpt.*, 11 (1920), pp. 35-38).—In a brief discussion of local cereal smuts it is stated that corn smut is not confined to any particular part of the plant or to any one period in its development. Field observations in western Nebraska show a large percentage of smutted plants to be affected with root and stem rot. Suggested control measures include development of resistant varieties, a measure hitherto apparently neglected.

A leaf spot of the peanut or monkeynut plant, P. A. VAN DER BIJL (*Union So. Africa Dept. Agr. Jour.*, 1 (1920), No. 6, pp. 528-530, figs. 2).—The object of this note is to call attention to the existence of a serious disease noticed especially along the coastal region of Natal on *Arachis hypogea*. The disease, due to *Septogloeum arachidis*, shows itself as black, circular to irregular spots or flecks which, though more prevalent on the leaves, occur also on the leaf-stalks and stems.

Leaf spots on peanut plants have been ascribed to *Cercospora personata*, which is claimed to be identical with *S. arachidis*. In South Africa this leaf

spot is recorded from the Transvaal, British East Africa, and Natal, and in other countries from Java, Ceylon, the Philippines, and the West Indies.

Controlling potato late blight in Wisconsin, R. E. VAUGHAN (*Potato Mag.*, 4 (1921), No. 2, pp. 7, 11).—Potato late blight (*Phytophthora infestans*) was under special observation in Wisconsin during the seasons of 1918 and 1919, this work being made possible by cooperation of the Plant Disease Survey, U. S. D. A., with the department of plant pathology, Wisconsin College of Agriculture. The material for this article is largely taken from the reports of W. H. Wright, who did most of the field work.

Apparently the original focus of infection was located in a low part of the field having a heavy silt loam soil, under such favorable conditions as cool, cloudy, and rainy weather. Three days later infection was general throughout the field and especially noticeable in the lower portions. Fields to the north also showed blight, indicating that wind may be a factor in spreading the blight fungus spores over limited distances.

Four applications of Bordeaux mixture (5:5:50) partially checked the disease, further spread of the blight being prevented by the appearance of dry weather about two weeks after the first outbreak. When dug September 25 following a killing frost on September 9, the tubers showed 18 per cent rot on the sprayed as compared with 50 per cent on the adjacent unsprayed area. It was noted that where the soil was well drawn up over the hills as soon as blight appeared, the rot amounted to only 20 per cent. Less rot occurred when the tubers were left undisturbed in the soil for at least 10 days after the vines were killed by blight. Digging when the soil was wet and sticky increased rot. The results of the tests show conclusively the advantage of storage in a dry bin as compared with storage in a vine-covered or hay-covered pit.

The results to date show that the severity of tuber rot is closely parallel to severity of foliage injury. The highest percentage of tuber rot occurs usually when vines are attacked shortly before tubers have reached maturity, and the great potato-growing sections of Wisconsin are probably never entirely free from late blight, so that there always exists the possibility of an epidemic if soil and climatic conditions are favorable.

Special adaptations of varieties to soils are indicated. Recent developments in connection with the Triumph potato are remarkable in that while the northern seed is generally freer from disease, the crop grown from this variety in the warmer climate is relatively highly diseased.

The results of inspection and observation have been valuable in furnishing cleaner seed of standard varieties to southern truck gardeners and have directly increased potato production in the South.

Relations between leptonecrosis and leaf roll, E. FOEX (*Soc. Path. Veg. France Bul.*, 8 (1921), No. 1, pp. 25-28).—A critical review is given of studies regarding leaf roll and leptonecrosis and their probable relations.

Relation of sulphur to control of potato scab, W. H. MARTIN (*Potato Mag.*, 3 (1921), No. 9, pp. 5, 6, 22, 23, figs. 6).—Potato scab is probably the most common potato disease, having been known at least as early as 1825, and having caused a loss of approximately 6,000,000 bu. in 1919. The history of the disease and the efforts to control it are briefly outlined. The bacterial organism causing scab is controllable by tuber treatment with formaldehyde or corrosive sublimate, if not too abundant in the soil. An acid reaction reduces the amount of infection from the soil.

An account is given of the author's experimentation to determine the value of sulphur for the control of scab. Sulphur appears to produce very good results under certain conditions, though the exact rôle it plays is not yet

known. Apparently the remedial effect depends upon the production of acid in the soil. Experimentation briefly indicated seems to show that the presence of sulphur-oxidizing organisms is important in this connection.

A two-minute treatment of seed potatoes, R. H. PORTER (*Potato Mag.*, 3 (1921), No. 9, pp. 8, 9, figs. 4).—The disinfection of potato seed tubers is accomplished by soaking them for two minutes in water at 118 to 122° F. which has received for each 30 gal. 2 pints of commercial formalin (40 per cent formaldehyde), then covering for one hour and drying. This formaldehyde method is said to equal mercuric chlorid in effectiveness and to exceed other methods in other respects under farm conditions.

Field tests in Mitchell County, Iowa, showed tubers grown from treated seed to rank 75 per cent higher in setting qualities and in freedom from disease than those from untreated seed. In a cooperative community test near St. Ansgar, Iowa, 530 bu. were treated in less than six hours at a cost of 7 cts. per bushel. Homemade apparatus for this purpose is described, with suggestions.

The potato wart situation, W. A. McCUBBIN (*Potato Mag.*, 3 (1921), No. 8, pp. 5, 26–28, figs. 2).—This account of potato wart, which appeared in Pennsylvania in 1918, sums up for the period ending with 1920 evidence considered to show that there is no cause for general alarm, since there are sufficient desirable immune varieties known to obviate a common menace to the potato in this country. Individuals and communities, however, may suffer inconvenience and loss for some time, as the disease remains infectious in the ground for at least 10 years, and is known also to attack related wild plants.

With the exception of a single farm in the eastern part of Pennsylvania, just outside a town where the disease was doubtless carried in fertilizing material, it is confined to mining or industrial towns, from which it can spread with difficulty through natural agencies. Restrictive measures are being applied to all infected areas now known, though others are supposed to exist.

Immune varieties are expected to constitute the chief defense of the potato crop against wart disease in this country. Of the numerous American varieties tested, 17 have proved immune, among which are such popular and widely grown varieties as Irish Cobbler, Green Mountain, Spaulding (Rose) 4, McCormick, and Early Petosky. At least 12 immune British varieties are said to be of high commercial value. A test of 12 immune British varieties in comparison with 7 standard American varieties made in 1920 at Weatherly, Pa., shows for the British a yield range of 130 to 473 bu. (5 above 410 bu.) as against a range of 194 to 399 bu. (4 above 312 bu.) for American varieties. The foreign immunes were to be subjected to further tests.

Wart disease of potatoes: Prevalence on the Continent; methods of control (*Jour. Min. Agr.* [London], 27 (1921), No. 11, pp. 1074–1076).—This is a summary regarding the prevalence of potato wart disease (*Synchytrium endobioticum*) in Europe and of control measures in the various countries, which has been compiled from the publications of the International Institute of Agriculture at Rome, and which is supplemented by a report prepared by one of the Ministry's inspectors who recently visited the Continent.

In Holland, wart disease has been discovered in the neighborhood of Winschoten, near Groningen, only a few isolated cases appearing. The disease is believed to have been introduced in infected potatoes carried by workmen from Germany. One Dutch variety, Ceres, was found to be immune, but this is not a very good cropper. Experiments are being continued with English varieties.

In Denmark, wart disease has not yet been observed. In Germany, wart disease appears in the Rhine District, especially south of Cologne, and also in

the Hamburg District and in Holstein. Scattered cases appear elsewhere, but fields are attacked only in the Rhine Provinces. Attempts at soil disinfection have not been fully satisfactory. Dormant spores were found in 1920 to have retained their vitality in the soil for at least 10 years.

In Norway, wart disease appeared in 1914 in two localities near Grimsmo, in the Kristiansand District. In spite of disinfection and other precautions the disease spread in 1915 and was reported from 27 other localities. In Sweden, the disease has been reported by Eriksson as occurring near Stockholm. In Austria, the disease had not appeared in 1920, but it was at that time established in Russian Poland. In France, the disease had not appeared in 1915. In Belgium, the disease had not been recorded officially, but probably existed near Ypres. In Luxemburg, the disease is said to have been widespread.

Sugar cane Fiji disease, A. SARRAUT (*Jour. Sta. Agron. Guadeloupe*, 1 (1921), No. 4, pp. 116-119).—Citations of accounts by various authors regarding the appearance and importance of Fiji sugar cane disease in different places are followed by an account of local regulations intended to give protection against this disease, which is claimed to be caused by an organism somewhat similar to *Plasmiodiophora brassicae*, the cause of cruciferous finger-and-toe disease.

Peronospora disease of tobacco, O. F. BURGER and H. C. PARHAM (*Fla. Plant Bd. Quart. Bul.*, 5 (1921), No. 4, pp. 163-167, fig. 1).—During late March and early April a threatening disease appeared in the tobacco seed beds of Gadsden County, Fla., and adjacent portions of Georgia, which has not been observed previously in Florida, and which was identified as *P. hyoscyami*. The disease is believed to have been introduced from Sumatra on the mats which are used to wrap the marketable product. The development of the disease is described.

Tobacco wildfire, G. H. CHAPMAN and P. J. ANDERSON (*Massachusetts Sta. Bul.* 203 (1921), pp. 67-81, pl. 1).—A preliminary account is given of investigations on the disease of tobacco known as wildfire. This disease, which is of a bacterial origin, is said to be especially infectious in the seed beds, although it also occurs on tobacco in the field. The life history of the causal organism, means of dissemination, source of infection, and methods of control are described.

For the control of tobacco wildfire, the authors recommend the use of seed from disease-free plants, sterilization of seed beds, weekly spraying or dusting seed beds with a fungicide from the time the plants are the size of the thumb nail until setting is complete, watering the beds only sufficiently to keep the plants growing, and thorough ventilation. Plants should be set from disease-free beds only. If any diseased plants are found in the field they should be removed and destroyed if badly infected, or if the infection is light or occurs late in the season diseased leaves should be picked and destroyed. As far as possible, working tobacco when the leaves are wet is to be avoided.

Pear and apple blight in Montana, D. B. SWINGLE (*Montana Sta. Circ.* 98 (1921), pp. 10, figs. 3).—This is a revised edition of a circular previously issued by the station (E. S. R., 23, p. 352).

A study of the June drop in peaches in Delaware, L. R. DETJEN (*Delaware Sta. Bul.* 129 (1921), pp. 14, 15).—A study was made of the June drop in peaches, which is generally attributed to incomplete fertilization. A large amount of cytological material was examined, and conclusive evidence is said to have been obtained indicating that the June drop in peaches is not the result of improper fertilization but of other factors not yet determined.

Control of brown rot of citrus fruits, H. S. FAWCETT (*Calif. Citrogr.*, 7 (1921), No. 1, p. 2).—*Pythiacystis citrophthora* is said to produce probably more damage to citrus trees in California than any other fungus. It causes, during

rainy weather, fruit brown rot and one of the most serious forms of gummosis of lemon, orange, and citrus trees. It lives and propagates best in moist soils.

The spores are spattered up from the ground during the rain, infecting plants and fruits unless dry weather occurs. Wash water in the packing house may also start the spread of the disease to healthy fruit, spoiling shipments. The disease was greatly reduced by preventive spraying with Bordeaux mixture, the best time for this treatment being just after the early fall rains. Bordeaux paste is also advised. Formulas are given for appropriate preparation of these fungicides.

The distribution of pink disease, H. A. LEE and H. S. YATES (*Philippine Agr. Rev.*, 13 (1920), No. 2, pp. 115, 116).—The opinion, expressed in a recent contribution (E. S. R., 42, p. 646), that citrus pink disease (*Corticium salmonicolor*) is of late introduction in the Philippines, is abandoned in consequence of recent information regarding the occurrence of isolated cases mentioned, no record appearing of any plant introductions during recent years.

Report on cold storage conditions for export fruit at Cape Town, I. B. P. EVANS (*Pretoria: Union So. Africa Dept. Agr.*, 1920, pp. 9, pl. 1).—Considerable wastage having occurred in connection with citrus fruit shipments from South Africa, investigations were instituted regarding conditions obtaining in the storing and shipping of these fruits at Cape Town. Conditions in the railway trucks or at the Government cold storage at the Cape Town docks were not found to explain satisfactorily the decay of fruit brought for export. Attention was, however, called to the passageways leading to and from the cool chambers, and to conditions in some of the chambers, as liable to spread infection. Further inspections and tests are considered necessary.

Further investigations into the cause of wastage in export citrus fruits from South Africa (*Union So. Africa, Dept. Agr. Bul.* 1 (1921), pp. 48, pls. 24).—The investigation begun by I. B. P. Evans, as indicated in the preliminary account above noted, has been specialized as indicated in the reports which appear below:

Introduction, I. B. P. Evans (pp. 1-4).—The continuation of this work locally has included also a study of conditions and operations in orchards and packing sheds. In addition, a plan has been carried out whereby fruit was picked, graded, and packed and then shipped to London in the usual way. The experimental packs were treated as were other shipments, except that they were subjected to examination, removal of waste fruits, and report at Cape Town. Control packs afforded a basis for comparison in order to show what ordinary care and precaution in handling can accomplish. The results of the investigations are said to show conclusively that with ordinary care and intelligent handling it is possible to place South African citrus fruits on the overseas markets showing only a negligible amount of waste.

In the orchards, however, the fruit must be kept free of scale and other puncturing insects, all fallen fruits must be destroyed, the fruit must be picked and handled with the greatest care, and it must be so packed in boxes as to prevent all possibility of injury. Packing sheds should be kept clean and should not be used for general storage when no packing is in progress. Fruit should be cured for at least three days with as little handling as possible. Grading should be so done as to prevent all injury. Boxes should be smooth, strong, and sufficiently open for ventilation, but not so made as to permit external injury to the fruit. Trucks should be clean and well ventilated, and should be so loaded as to allow free circulation of air. Careful handling at all points is essential. Attention is directed to the fact that fruit kept under conditions regarded as essential remained perfectly sound and sweet for four months.

Investigations into the cause of wastage in export citrus fruit, M. R. H. Thomson (pp. 5-27).—In addition to the investigations outlined above, mycological examinations in Pretoria were made extending over a considerable period, and many inoculation experiments on oranges were carried out with the fungi obtained from the atmosphere outside the citrus zone, in orchards, packing sheds, fruit trucks, boxwood, returned empties, and fruit packs. The results show no evidence of any very serious fungus pests in the orchards which can not be overcome or avoided if ordinary precautions are taken in handling the fruit.

The wastage, so far as had been determined in South African fruit, is caused mainly by the olive-green mold (*Penicillium digitatum*), which apparently gains entrance to the fruit only through some injury to the skin. The work is described in considerable detail.

On the export of oranges from South Africa during the season 1920, with special reference to the causes of wastage in the fruit, V. A. Putterill (pp. 28-36).—During 1920, consignments of oranges of the varieties Transvaal Seedling, Washington Navel, Valencia Late, and Du Roi were picked and packed by a specially instructed staff of men at packing houses in the Rustenburg District. By careful handling, fruit injury was reduced to a minimum and the results in general were very gratifying. Olive-green mold (*P. digitatum*), blue mold (*P. italicum*) anthracnose (*Colletotrichum gloeosporioides*), and a sooty mold following scale insect attack were practically the only fungi found on the fruits. The amount of wastage due to molds appears to be directly proportional to the amount of injury sustained by the fruit in the orchard and in packing house. Examples cited seem to prove that wounds are essential for the entrance of the above named *Penicillium* into the fruit.

The outstanding fact of all the observations made is that the success of the industry depends more on the individual care and foresight of the grower in handling and packing the fruit than on such more obscure and less easily remedied factors as the numbers of fruit-rotting organisms present, and climatic bearings.

Export of citrus fruits: Observations in London, G. Hobson (pp. 36-41).—Observations reported by the chief inspector indicate that South African citrus fruits subjected to the precautions described in the above accounts reach the London markets in a much sounder and much better condition than is usually the case. The fact that sound fruits frequently found embedded in a mass of rotten fruits were shown on examination to be free from wounds or blemishes is taken to indicate that injury to the skin is a necessary condition to attack by the fruit-rot organisms.

Pecan rosette—a practical discussion, W. A. WEAVER (*Amer. Nut Jour.*, 14 (1921), No. 3, pp. 26, 30, 31).—The author, having made a study of rosette, concludes that this disease is caused primarily by a relatively insufficient water supply and water-absorption with reference to transpirational loss. The evidence bearing on this point is briefly outlined in connection with a discussion of the influences of mineral fertilizer, cover crops, pruning, and varieties.

The dying out of walnut in France, GARD (*Soc. Path. Veg. France Bul.*, 8 (1921), No. 1, pp. 41-44).—A brief discussion is given regarding causes of bad conditions and losses associated with fungus and other disease agencies affecting walnut trees in portions of France.

Rust of Antirrhinum, W. L. DORAN (*Massachusetts Sta. Bul.* 202 (1921), pp. 39-66, pl. 1, figs. 6).—A detailed account is given of a study of a rust of snapdragons due to *Puccinia antirrhini*. This rust is said to be the most serious disease of snapdragon under glass, and is second in importance to anthracnose in snapdragon out of doors. No varieties have been found absolutely

resistant to the fungus, although some are relatively resistant. The varietal resistance is considered dependent on the relative number of stomata per unit area of leaf surface.

Experiments for the control of this rust have shown that copper sulphate, cuprammonium sulphate, and sulphur dioxide generated by dry sulphur at a temperature of 21° C. (69.8° F.) are toxic to the urediniospores, while Bordeaux mixture is not toxic. For the control of the disease, the author recommends the growing of resistant varieties, controlling cultural conditions, dusting with powdered sulphur at a temperature of 70° F., and keeping the night temperature of the snapdragon house above 52 or below 48°.

Septoria antirrhini, V. DUCOMET (*Soc. Path. Veg. France Bul.*, 8 (1921), No. 1, p. 33).—*S. antirrhini* attacks severely snapdragon when the plant has been subjected to the loss of a large portion of its roots. The fungus is therefore regarded as normally parasitic on wounded plants only.

The Botrytis blight of tulips, E. F. HOPKINS (*New York Cornell Sta. Mem.* 45 (1921), pp. 315–361, pl. 1, figs. 29).—A report is given of an investigation of the tulip disease caused by *B. tulipae*, which is said to be present throughout the United States and which was probably introduced with the introduction of tulip bulbs. Under normal conditions the disease seems to be restricted to the genus *Tulipa* and within this genus practically all varieties are more or less susceptible.

The characteristics of the disease, morphology, physiology, pathogenicity of the organism, and means of control are described at length. The disease is said to be easily recognized on the bulbs when the fungus sclerotia are present in the lesions. A severe blighting frequently takes place on the leaves, the flower stalks, and the flowers. The fungus hibernates on the bulbs.

While extensive control experiments have not been made, the author recommends the use of clean bulbs, their careful handling, proper storage, and the systematic removal and destruction of diseased plants in the field.

White pine blister rust work in Oregon, G. A. ROOT (*Oreg. Bd. Hort. Bien. Rpt.*, 16 (1919–20), pp. 176–181, figs. 3).—An account of measures to prevent the introduction of white pine blister rust (*Peridermium pini*, *Cronartium ribicola*) into Oregon sketches also the history of this disease elsewhere, including its ravages, control measures, and cost of control.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

The relative toxicity of strychnin to the rat, E. W. SCHWARTZ (*U. S. Dept. Agr. Bul.* 1023 (1922), pp. 19).—In the course of investigations by the Bureau of Chemistry it was found that the limit of tolerance of *Mus novegicus* to strychnin administered subcutaneously is from 3 to 3.5 mg. per kilogram. The guinea pig alone of the comparatively few species of mammals for which accurate data are available possesses greater resistance. The size of the subcutaneous lethal dose (species tolerance) remains constant when a certain definite experimental procedure is followed. General or mixed diets and seasons had no effect upon the species tolerance in the series here reported. In these experiments the rat showed a remarkable ability to dispose of strychnin, the calculated disposal under favorable conditions amounting to 1 mg. per hour, that is, one-third of a minimum lethal subcutaneous dose. Immature rats differ from the adult rats both in toxicity of and reactions to strychnin, which seems to be correlated with the functional development of their nervous systems.

“The practically certain oral lethal dose of strychnin is from 20 to 25 mg. per kilogram of the free alkaloid, equivalent when calculated as the sulphate

to from 25.6 to 32 mg. The ratio of the subcutaneous lethal doses to the oral lethal doses is about 1:8 or 1:9. The reason for this high ratio in rats would seem to be that when less than a lethal dose has been given the stomach and its contents directly or indirectly hinder absorption. On this account the animal can prevent the accumulation of a lethal amount within the system by the rapid disposal. When a lethal dose is administered by mouth the fatality usually occurs within several hours. The rat, therefore, must be overwhelmed by the drug; otherwise, it probably will survive. At times this certainly involves the play of a usually subordinate function, gastric absorption.

"Mice are more susceptible to strychnin than rats, both to subcutaneous injections and to doses orally administered. Ground squirrels (*Citellus richardsoni*) are about four or five times more sensitive to strychnin administered subcutaneously than rats. This helps to account for the comparative difficulty in poisoning rats.

"The percentage of strychnin which would make a successful rat bait can not be stated at present. After the factors of rapid consumption and palatability are solved, it should be possible to obtain good results with 0.75 per cent of the alkaloid in potent form in the formula. This percentage represents three times the fairly certain fatal dose in a meal of the average size."

A list is given of 30 references to the literature cited.

Observations upon the resistance of the rat to consecutive injections of strychnin. E. W. SCHWARTZE (*Jour. Pharmacol. and Expt. Ther.*, 19 (1922), No. 1, pp. 49-58).—Investigation has been made of the tolerance of the rat to repeated injections of strychnin. The results indicate that the coefficients of disposal, which are necessarily expressed in terms of percentage of minimum lethal dose per given period of two hours, are too low. "They should be reinterpreted to fit the case of oral administration, in which large amounts are administered at once and in which type of experimentation the adsorption of strychnin has an opportunity to keep pace with the disposal. Accordingly, the coefficient of disposal has been regarded as constant and the absolute amount disposed of as a variable depending on the amount present. On this basis the disposal of strychnin by the rat may reach at least 1 mg. per kilogram per hour. This occurs only when the strychninization is kept constantly very close to the maximum limit, by absorption from the gastrointestinal tract. The coefficients as determined arithmetically have been checked by a new experimental criterion, namely, the relation of survivals to fatalities in a given uniformly treated series and comparison of one such series with another. The extremely high tolerance of the rat, as well as of other animals, to consecutive injections of strychnin would seem to be significant in respect to the possibility of correlating this with the failure to demonstrate as yet an habituation to this drug."

The fur trade and the fur supply. F. G. ASHBROOK (*Jour. Mammalogy*, 3 (1922), No. 1, pp. 1-7).

Two new skunks of the genus *Conepatus*. E. A. GOLDMAN (*Jour. Mammalogy*, 3 (1922), No. 1, pp. 40, 41).

Parasitism and symbiosis. M. CAULLERY (*Le Parasitisme et la Symbiose. Paris: Libr. Octave Doin*, 1922, pp. 400, figs. 53).—This work treats of commensalism, inquilinism, adaptation to parasitism, reciprocal actions of the parasite and host, symbiosis in plants and in animals, etc. A classified bibliography (pp. 357-387) and an index are included.

A correction concerning the life zones of Canada. A. B. KLUGH (*Biol. Bul. Mar. Biol. Lab. Woods Hole*, 41 (1921), No. 5, pp. 272-275, fig. 1).—The author's

observations during a period of eight years have led to a correction in the border line between the transition and Canadian zones in Ontario as reported by Merriam (E. S. R., 10, p. 724).

[Report of the] Government entomologist, C. C. GOWDEY (*Jamaica Dept. Agr. Ann. Rpt.*, 1920, pp. 25-27).—This is a brief report on the occurrence of the more important insect pests of the year by the Government entomologist in Jamaica, who assumed his duties on July 26, 1920.

Some recent insect immigrants in the Hawaiian Islands, O. H. SWEZEY (*Jour. Econ. Ent.*, 14 (1921), No. 3, pp. 254-258).—The author presents notes on the distribution, habits, and importance of some insect immigrants that were noted during the years 1919 and 1920.

British insect life, E. STEP (London: T. Werner Laurie, Ltd., pp. 264, pls. 33).—A popular account of insects.

Insect and arachnid pests of 1920, R. S. MACDOUGALL (*Highland and Agr. Soc. Scot. Trans.*, 5. ser., 33 (1921), pp. 105-142, figs. 18).—Summarized accounts are given of some of the more important insect pests of the year 1920.

Short notes on the insect pests of crops in Travancore, R. MADHAVAN PILLAI (*Trivandrum: Travancore Dept. Agr.*, 1921, pp. VIII+52).—This is a collection of notes on insect pests, in Travancore, of rice, little millet (*Panicum miliare*), coconut palm, Palmyra palm, betel-nut palm, ginger, castor bean, gingelly (*Sesamum indicum*), kachil (*Dioscorea* sp.), and 32 other crops.

Entomology, A. H. KIRBY (*South. Provs., Nigeria, Agr. Dept. Ann. Rpt.*, 1920-21, pp. 21-23).—This is a report of observations of the occurrence of and work with insects affecting crops in Nigeria during the period under report.

South African cotton insects, G. C. HAINES (*Union So. Africa Dept. Agr. Jour.*, 3 (1921), No. 5, pp. 425-430).—This is a brief summarized account of the more important insects attacking cotton in South Africa.

Fruit foes, T. W. SANDERS (London: W. H. & L. Collingridge, 1921, pp. 106, pls. 29, figs. 31).—A discussion of the insect and other animal pests and fungus diseases of fruit trees and means for their control.

Notes on milkweed insects in New Jersey, H. B. WEISS and E. L. DICKERSON (*Jour. N. Y. Ent. Soc.*, 29 (1921), No. 3-4, pp. 123-145).—This account is based upon observations of insects associated with *Asclepias syriaca*, the common species of the Eastern States, and *A. pulchra*, which is considered a variety of *A. incarnata*.

Biological control of the prickly-pear pest, T. H. JOHNSTON (*Queensland Agr. Jour.*, 16 (1921), No. 2, pp. 65-68).—This relates particularly to work with the insect enemies of the prickly pear, a large consignment of which has reached Queensland from Florida and Texas.

The social habits of *Termes lucifugus*; its ravages and its control, J. FEYTAUD (*La Cité des Termites, Moeurs Sociales du Termite lucifuge; ses Ravages, sa Destruction*. Paris: L. Lhomme, 1921, pp. 134, figs. 10).—An account of the bionomics of termites in general and of this important species in particular.

The destruction of termites by chloropicrin, J. FEYTAUD (*Compt. Rend. Acad. Sci. [Paris]*, 171 (1920), No. 8, pp. 440-442; abs. in *Internatl. Inst. Agr. [Rome]*, *Internatl. Rev. Sci. and Pract. Agr.*, 12 (1921), No. 1, p. 139).—Laboratory experiments by the author show that chloropicrin vapor is effective against *Leucotermes lucifugus* Rossi. At a temperature of 20° C. (68° F.), 2 mg. of chloropicrin per liter was sufficient with 12 hours' exposure and 5 mg. with 6 hours' exposure to destroy all the termites set free within a bell glass and others living at a depth of 10 cm. (3.9 in.) in pieces of wood. An application of this method in a three-story building confirmed the results obtained in the laboratory experiments.

Locusts and means for their control, edited by H. BÜCHER (*Monog. Angew. Ent. No. 3* (1918), pp. XIII+274, pls. 22, figs. 42).—The several parts of this work consist of a discussion of the locust question and the history of outbreaks of *Stauronotus maroccanus* in Turkey (pp. 1-25), means for their control (pp. 26-89), the control organization and results obtained in 1916 and 1917 (pp. 90-156), and the biology of the Moroccan migratory locusts and observations in Asia Minor in 1916 and 1917 (pp. 157-274).

Observations on the attractiveness of materials used in grasshopper baits, A. L. FORD and W. H. LARRIMER (*Jour. Econ. Ent.*, 14 (1921), No. 3, pp. 285-291).—The work with grasshopper baits here reported indicates that, under Indiana conditions at least, fruit flavors in bran mash when used against *Melanoplus femur-rubrum* are not necessary. Blackstrap molasses was found to be the best of the flavor combination used, it being better than any of the sirups tested and the others being only slightly better than wet bran alone. Salt did not add to the attractiveness of poison bran mash. Sawdust and bran used in equal parts as a body material for mash attracted 36.9 per cent more hoppers than sawdust alone, and nearly as many as when wheat bran alone was used.

Grasshopper and cricket repellents, W. H. LARRIMER (*Jour. Econ. Ent.*, 14 (1921), No. 3, pp. 259-263).—In the work with repellents, data relating to which are presented in tabular form, the various materials are listed in order of their repellent qualities as follows: Copper sulphate (easily the most promising), kerosene, auto oil, nicotin sulphate, nitrobenzene, furniture polish, creosote oil, alioes, sulphur, gasoline, water, blackstrap molasses, and soap. The relative unconcern with which both crickets and grasshoppers ate the bran, even when heavily treated with materials commonly regarded as repellents and especially their almost unbelievable fondness for soap, are said to be the most remarkable features of the experiment. It was found in a field test that soap is not only of value as an attractive substance when used in the preparation of poison mash but also considerably improves the mechanical condition of the mash.

The effect of poison bran mash on grasshoppers and the lapse of time between poisoning and death, A. L. FORD (*Jour. Econ. Ent.*, 14 (1921), No. 3, pp. 281-285).—The data reported have shown that while grasshoppers may appear healthy and active for many hours after eating poison bran mash they consume one-ninth as much food as unpoisoned grasshoppers. The last experiment conducted seems to indicate that it takes very little poison bran mash to kill a hopper, and those receiving smaller amounts die just as soon and eat just as little as those receiving larger amounts.

Some factors influencing the efficiency of grasshopper baits, A. L. FORD and W. H. LARRIMER (*Jour. Econ. Ent.*, 14 (1921), No. 3, pp. 292-299).—It was found that blackstrap molasses gave much better results than any of the other sirups used. "The optimum strengths for the three standard poisons was found to be Paris green 0.5 lb., white arsenic 0.75 lb., and crude arsenic 1.5 lbs. per each 25 lbs. of bran. The optimum rate of applying poison bait was found to be 7.5 lbs. of the wet mash per acre; however, a general recommendation of from 5 to 10 lbs. per acre might well be made. There was very little difference in the three arsenicals when run under similar conditions at their optimum strengths and rates."

A thrips injury to apples, E. J. NEWCOMER (*Better Fruit*, 16 (1921), No. 4, p. 10, figs. 2).—In investigations extending over several years the author has discovered that certain irregular whitish spots which have been quite prevalent on almost all varieties of apples in the Pacific Northwest are caused by the oviposition of an undetermined species of thrips. Although this thrips injury is of

no consequence in most of the commercial varieties and is inconspicuous at picking time, in certain varieties, namely, the McIntosh, Senator, York, and Northern Spy, the spots persist and cause the affected fruit to be lowered in grade. It is thought that an application of miscible or distillate oil and nicotin sulphate at the time of the "ping" spray should materially reduce the injury.

Bionomics of the chinch bug, P. LUGENBILL (*U. S. Dept. Agr. Bul. 1016* (1922), pp. 14, figs. 2).—This is a report of biological studies of the chinch bug in South Carolina.

In experiments conducted at the laboratory at Columbia, it was determined that in that locality the species has six instars instead of five, exclusive of the egg stage, as has been previously recorded, namely, five nymphal stages and an adult stage. Much of the data relating to the life history of the species is presented in tabular form. Technical descriptions are given of the immature stages. A single specimen of the tachinid fly *Phoranthia occidentis* Wlk. was reared from a male individual.

Minimum incubation periods of causative agent of curly leaf in beet leafhopper and sugar beet, H. H. P. SEVERIN (*Phytopathology*, 11 (1921), No. 10, pp. 424-429, figs. 4).—The author's studies at the California Experiment Station show that the beet leafhopper is noninfective when it hatches from the egg, that curly leaf is not transmitted through the seeds from "stechlinge" affected with the disease before and after transplanting, and that the beet leafhopper is not a mechanical carrier of curly leaf nor a mechanical carrier in mass infection of a beet. The minimum incubation period of the causative agent of curly leaf in the beet leafhopper was four hours at a temperature the maximum of which was 103° F., the minimum 94°, and the mean 100°, and in the sugar beet five days at a temperature the maximum of which was 93.6°, the minimum 53.3°, and the mean 72.8°.

At close quarters with the mealy bug; inspection of grapes an aid to preventing spread in vineyards, A. J. FLEBUT (*Associated Grower*, 2 (1921), No. 8, pp. 13, 48, fig. 1).

Spraying for San José scale, W. J. BAERG (*Arkansas Sta. Bul. 177* (1921), pp. 3-19, figs. 2).—This is a report of investigations conducted during the years 1919 to 1921 in three separate orchards containing, 4-, 6 to 8-, and 10 to 15-year-old trees, respectively. The experiments have shown that lime sulphur is the most effective of all the materials tested, the others, arranged in order of their efficiency and advantages, being as follows: Scalecide, dry lime sulphur, barium tetrasulphid, and soluble sulphur. It is pointed out that dormant spraying, in order to be effective, must be done so thoroughly that every portion of the infested tree is covered with the spray material. The spring application of the dormant spray is most effective, and this must be finished before the buds begin to separate.

Controlling the Achemon sphinx moth, A. J. FLEBUT (*Associated Grower*, 2 (1921), No. 8, p. 11).—The author reports that an application of a spray consisting of lead arsenate paste 10 lbs., atomic sulphur 24 lbs., ground glue 1 lb., and water 200 gal., applied at a pressure of about 250 lbs., starting on May 16 and completed on June 9, resulted in the prevention of injury by the Achemon sphinx moth in a large vineyard near Livingston, Merced Co., Calif.

The possibilities of economic harm in the spread of the pink cotton bollworm in the United States, A. R. MARSH (*Econ. World*, n. ser., 22 (1921), No. 24, pp. 867, 868).—The results that may follow from the attacks of this pest upon cotton in the United States are considered.

A new moth pest of sugar cane and maize; leaf-eating grass worm (*Laphygma exempta* Walk.), E. JARVIS (*Queensland Agr. Jour.*, 16 (1921), No. 4, pp. 276-280, figs. 5).—A brief account is given of this enemy of sugar

cane and corn and means for its control in Queensland. Its appearance first came to the author's attention at Meringa, near Cairns, in February, 1920.

Notes on a destructive lawn insect, G. F. MOZNETTE (*Fla. Grower*, 24 (1921), No. 22, p. 13).—The author reports that *Crambus haytiellus* Zinck. was a source of considerable injury to lawns at Miami and Cocoanut Grove, Fla., during the spring and early summer of 1921. The grasses attacked included Bermuda grass (*Cynadon dactylon*) and Japanese grass (*Zoysia japonica*), the injury being particularly severe to the latter. The tubes containing the larvae are located in the thickly massed grass roots and runners either on or just below the surface of the soil, where they feed upon the grass with which they come in contact. Preliminary tests made with several insecticides indicate that good results may be obtained from the use of tobacco dust applied with a dust gun. Where lawns were thus treated the larvae were either killed or they migrated from the dusted plot.

The life history of the oriental fruit moth in northern Virginia, L. A. STEARNS (*Virginia Sta. Tech. Bul.* 21 (1921), pp. 3-46, figs. 8).—This is a detailed report of seasonal life history studies of *Laspeyresia molesta* Busck, conducted in an extensive open-air insectary at a field laboratory at Leesburg, Loudoun Co., during the years 1919 and 1920. The details of the work are presented in 52 tables.

In northern Virginia there were four complete generations of the oriental fruit moth (*L. molesta*) during these years. In 1919 a whole fourth brood of larvae developed and cocooned for hibernation, pupating and emerging as the spring brood of 1920. Only a partial fourth brood was recorded in 1920, due to the fact that a small percentage of the third brood larvae failed to transform. It is thought that this is of normal occurrence, and that the "wintering larvae" include individuals of both the third and fourth broods of the preceding season. All generations were found to overlap in a greater or less degree.

The pupation period of the spring brood varied from March 10 to May 18. The average length of the pupal stage was 35.06 days. Moths emerged from April 22 to June 7, the maximum emergence occurring during the first 10 days in May. The preoviposition period of the spring brood moths averaged 4.6 days. Oviposition of the moths commenced May 7 in 1919 and May 10 in 1920 and continued for 23 days. The average length of the incubation of eggs was 7.39 days in 1919 and 8.66 days in 1920. The larval period of the first brood averaged 18.98 days in 1919 and 21.35 days in 1920. The larval period in the cocoon was 3.92 days in 1919 and 4.02 days in 1920. The pupal period averaged 10.57 days in 1919 and 11.22 days in 1920. Moths emerged from June 18 to July 12. For both years the maximum emergence occurred during the last week in June and the first week in July. The average length of life of moths was 8.8 days in 1919 and 10.9 days in 1920. In 1919 an average of 37.6 days was required for the life cycle of the first generation and in 1920 42.62 days.

The preoviposition period of the first brood moths averaged 2.25 days in 1919 and 3.285 days in 1920. Oviposition commenced June 23 in 1919 and June 27 in 1920. The average length of the incubation of eggs was 5.38 days in 1919 and 4.89 days in 1920. The length of the feeding period of the larvae averaged 14.57 days in 1919 and 13.73 days in 1920. The average larval life in the cocoon was 3.78 days in 1919 and 3.98 days in 1920. The pupal stage averaged 9.1 days in 1919 and 10.05 days in 1920. Moths of the second brood emerged from July 6 to August 17. An average of 33.15 days was required for the life cycle in 1919 and 31.88 days in 1920.

The preoviposition period of the second brood moths averaged 2.375 days in 1919 and 3.428 days in 1920. Oviposition commenced July 10 in 1919 and July 14 in 1920. The average length of the incubation of eggs was 5.25 days in 1919 and 4.36 days in 1920. The length of the feeding period of third brood larvae averaged 17.109 days in 1919 and 13.83 days in 1920. The average larval life in the cocoon was 3.24 days in 1919 and 4.33 days in 1920. The wintering larvae of this brood cocooned for hibernation during the first 12 days of September. The pupal stage averaged 9.31 days in 1919 and 10.69 days in 1920. Moths emerged from August 13 to 29 in 1919 and from August 15 to October 3 in 1920. For both years the maximum emergence occurred between August 15 and September 7. The average length of life of moths was 14.205 days in 1919 and 13.84 days in 1920. An average of 33.74 days was required for the life cycle in 1919 and 33.02 days in 1920.

The preoviposition period of the third brood moths averaged 4.56 days in 1919 and 4.074 days in 1920. Oviposition commenced August 24 in 1919, continuing 15 days, while in 1920 eggs were first deposited August 18 and the last on October 8. The average length of their incubation was 5.59 days in 1919 and 5.87 days in 1920. The length of the feeding period of the larvae averaged 45.43 days in 1919 and 25.49 days in 1920. The marked difference in these two averages is thought to be due to climatic conditions which made possible a continuance of late feeding in fruit in 1919. The fourth broods of 1919 and 1920 were 100 per cent wintering larvae. In 1919 larvae commenced cocooning for hibernation September 30, and the last cocooning record was November 8. In 1920 cocooning extended over a period of 60 days, from September 7 to November 5. The maximum cocooning occurred in 1919 from October 1 to 25 and in 1920 from September 12 to 27.

A bibliography of 19 titles and a diagram showing the seasonal life history of the oriental moth in northern Virginia during 1919 and 1920 are included.

Life history of *Pyrausta ainsliei* Heinr. at Ames, Iowa, during the season of 1920. I. L. RESSLER (*Jour. Econ. Ent.*, 14 (1921), No. 3, pp. 277-280, fig. 1).—The author's studies have shown that the life history of *P. ainsliei* at Ames is quite similar to that reported for the European corn borer in Massachusetts. A diagram is given of its life history, showing also the average temperature and the average humidity for the season of 1920 at Ames.

Observations on the fall army worm (*Laphygma frugiperda* S. & A.) and some control experiments. R. C. SMITH (*Jour. Econ. Ent.*, 14 (1921), No. 3, pp. 300-305).—In an outbreak of the fall army worm which occurred in central and east central Kansas in September, 1920, the use of poison bran mash made with Paris green gave satisfactory results. Sawdust substituted for the bran was less attractive to the larvae and a lesser killing was made.

Life history of the variegated cutworm. F. M. WADLEY (*Jour. Econ. Ent.*, 14 (1921), No. 3, pp. 272-277).—This is a report of work with *Lycophotia margaritosa saucia* Hübn. conducted at Wichita, Kans., in 1915. Observations made of two consecutive generations in that year confirm the conclusion that the average time required for a generation in summer is not far from 50 days in southern Kansas.

Caterpillars attacking cedar cones. J. DE JOANNIS (*Bul. Sta. Forest. Nord Afrique*, 1 (1921), No. 6, pp. 187-199, pls. 2).—Accounts are given of nine species of Dioryctria, one of which is described as new.

The influence of the H-ion concentration in the development of mosquito larvae. M. E. MACGREGOR (*Parasitology*, 13 (1921), No. 4, pp. 348-351).—The author concludes that the H-ion concentration has a profound effect upon the metabolism of mosquito larvae and their resistance to disease.

The earliest name of the yellow fever mosquito, H. G. DYAR (*Insector Inscitiae Menstruus*, 8 (1920), No. 10-12, p. 204).—It is pointed out that the yellow fever mosquito was first described by Linnaeus in 1762 as *Culex aegypti* and should be known as *Aedes aegypti*.

The warble fly problem, A. SEYMOUR-JONES (*Jour. Amer. Leather Chem. Assoc.*, 17 (1922), No. 1, pp. 15-26).—This is a summary of information presented to the division of leather chemistry at the meeting of the American Chemical Society at New York in September, 1921, in which reference is made to recent investigations, including those of Carpenter et al. in Ireland (E. S. R., 32, p. 680), Schöttler and Glaeser in Germany (E. S. R., 32, p. 581), Hadwen in Canada (E. S. R., 39, p. 157), etc. A report of extended investigations of the warble flies by Laake, of the U. S. D. A. Bureau of Entomology, has been noted (E. S. R., 45, p. 555).

An illustrated synopsis of the puparia of 100 muscoid flies (Diptera), C. T. GREENE (*U. S. Natl. Mus. Proc.*, 60 (1921), Art. 10, pp. 1-39, pls. 20).—Following a brief introduction, keys are given to several groups, followed by descriptions of the puparia of 99 species.

Sheep-maggot flies and their parasites, W. W. FROGGATT (*Agr. Gaz. N. S. Wales*, 32 (1921), Nos. 10, pp. 725-731, figs. 2; 11, pp. 807-813, fig. 1).—This is a report of observations made during investigations at the Government Sheep-fly Experiment Station, at Warrah, in 1920-21.

The stable fly, J. WILHELM (*Monog. Angew. Ent. No. 2* (1921), pp. 110, figs. 28).—Investigations by the author of *Stomoxys calcitrans* L., particularly as to its occurrence, life history, and habits, are reported. The paper includes a bibliography of six pages arranged in chronological order. Studies of this insect in the United States by Bishopp have been noted (E. S. R., 29, p. 256; 43, p. 362).

Experimental studies on the duration of life, R. PEARL and S. L. PARKER (*Amer. Nat.*, 55 (1921), No. 641, pp. 481-509, figs. 6).—This paper is the first in a series of experimental studies on the factors influencing the duration of life in *Drosophila melanogaster*. The paper includes a bibliography of 26 titles.

A new cerambycid beetle from Santo Domingo, W. S. FISHER (*Ent. News*, 33 (1922), No. 2, p. 52).

The status of the work against the Japanese beetle, C. H. HADLEY (*Jour. Econ. Ent.*, 14 (1921), No. 3, pp. 249-253).—This is a further discussion (E. S. R., 43, p. 362) of the work against *Popillia japonica* Newm. in this country, with particular reference to the lines to be followed.

North American sawflies of the subfamily Cladiinae, with notes on habits and descriptions of larvae, S. A. ROHWER and W. MIDDLETON (*U. S. Natl. Mus. Proc.*, 60 (1922), Art. 1, pp. 1-46, pls. 7).—This paper includes descriptions of nine new species by Rohwer and notes on the habits and descriptions of the larvae by Middleton.

Notes on the dodder gall weevil, *Smicronyx sculpticollis* Casey, H. B. WEISS and E. WEST (*Ohio Jour. Sci.*, 22 (1921), No. 2, pp. 63-65, fig. 1).—A report of observations of this weevil at Monmouth Junction, N. J. Most of the beetles leave the galls during the first half of September and later in central New Jersey, emergence taking place through a circular opening in the side.

The response of the bean weevil to different percentages of atmospheric moisture, T. J. HEADLEE (*Jour. Econ. Ent.*, 14 (1921), No. 3, pp. 264-269, fig. 1).—This is a progress report of work previously noted (E. S. R., 37, p. 254). Three distinct sets of experiments have been completed, and curves which have been constructed on the basis of the average of the experiments are presented.

The spinose ear tick; practical suggestions for suppression, C. STORY (*Union So. Africa Dept. Agr. Jour.*, 1 (1920), No. 7, pp. 647-654, fig. 1).—A

report of observations and experiences with this pest in South Africa, with comments by C. P. Lounsbury.

A note on the control of red spider, T. PARKER (*Fruit, Flower, and Veg. Trades' Jour.* [London], 40 (1921), No. 26, pp. 689, 691).—"Spraying for red spider on carnations is very unsatisfactory owing to the waxy bloom, which causes the spray fluid to collect in globules at the axils of the leaf. Dipping produces much better results, but this method can only be applied to potted plants when not in bloom and must be repeated once or twice. Liver of sulphur and petroleum emulsion gives the best results in the dipping experiments in killing the spider without damaging the plants. There is, however, the disadvantage of foliage staining due to the depositions from the dipping solutions. Liver of sulphur and chlorocresols are quite effective in controlling carnation 'rust'. Fumigating with either the tetra or pentachlorethane at the rate of 10 or 20 fluid ounces to 1,000 cu. ft. for 12 hours produces uncertain results without any deleterious effect upon the carnations. Nicotin petroleum emulsion containing 2 per cent nicotin and 50 per cent petroleum oils is quite effective in controlling the red spider on cucumbers, providing that the sprayings are carried out at the dilutions suggested and in the manner prescribed."

Preliminary notes on control of millipedes under sash, J. L. HORSEFALL and J. R. EYER (*Jour. Econ. Ent.*, 14 (1921), No. 3, pp. 269-272).—The injury by millipedes to truck crops in eastern Pennsylvania in the fall of 1910 led to the work here reported.

In the experiments on plats, each of which comprised an area of 48 sq. ft., it was found that sodium cyanid, nicotin sulphate solution, or nicotin sulphate in the form of a dust gave perfect stands of lettuce. "The plat treated with sodium cyanid at the rate of 150 lbs. to the acre, when applied in furrows and covered with soil one week before planting, showed an increase of 256 plants over the untreated plat. Nicotin sulphate, diluted one part in 200 parts of water, when sprinkled on a newly seeded bed resulted in an increase of 224 plants as compared with the check. This plat had been previously limed, but, as shown in other tests, lime did not factor as a control measure. Two per cent nicotin sulphate as a dust increased the stand 144 plants. Sweetened poison bait controlled millipedes in the spring, but proved inefficient in autumn as a protection in fall seeded frames."

Tularaemia Francis 1921 (*Pub. Health Rpts.* [U. S.], 37 (1922), No. 3, pp. 83-115).—Three papers are here presented in continuation of those previously noted (*E. S. R.*, 46, p. 151).

IV. *Transmission of tularaemia by the bedbug (Cimex lectularius L.)*, E. Francis and G. C. Lake (pp. 83-95).—In the experiments here reported the bedbug transmitted the affection from infected to healthy mice in 10 instances, in which the intervals which elapsed between biting the infected and biting the healthy mice were a few seconds, 18 hours, 7 days, 15 days, and 71 days. The exact parts played by bites and by feces in the 10 transmissions are said to be impossible of determination. White mice readily eat living and dead bugs, and when they thus ingest infected bugs the mice usually contract tularaemia. Guinea pigs bitten by infected bugs failed to contract the disease with one exception, which is thought to have been due to the unintentional ingestion of an infected bug. The fresh feces of bedbugs infected by *Bacterium tularense* by sucking the blood of infected white mice, which were fed every 10 days thereafter on the blood of healthy white mice, contained virulent organisms of this infection at all times and up to 120 days after the date of infection of the bugs. *B. tularense* suffered no apparent diminution of virulence by reason of long residence in bedbugs.

V. *Transmission of tularaemia by the mouse louse Polyplax serratus Burm.*, E. Francis and G. C. Lake (pp. 96-101).—The transmission of tularaemia was effected in 12 out of 17 attempts through the agency of the mouse louse *P. serratus* by the transfer of lice from white mice dead of tularaemia to healthy white mice, the intervals elapsing between infestation of the healthy mice and their deaths varying from 5 to 12 days, with an average of 7.25 days. Blood-sucking mites of the species *Liponyssus isabellinus* removed from an infected white mouse were crushed and injected subcutaneously into another white mouse, causing its death from tularaemia.

VI. *Cultivation of B. tularensis on mediums new to this organism*, E. Francis (pp. 102-115).—The author records the growth of this organism in subcultures on serum glucose agar, glucose blood agar, and blood agar. The growth on these mediums per se is scanty and of lowered virulence. The view heretofore held that *B. tularensis* will grow only on a culture medium containing egg yolk is thus no longer tenable.

FOODS—HUMAN NUTRITION.

Relation of initial temperature to pressure, vacuum, and temperature changes in the container during canning operations, C. A. MAGOON and C. W. CULPEPPER (*U. S. Dept. Agr. Bul. 1022 (1922), pp. 52, figs. 37*).—In this publication the authors have extended their studies of the fundamental factors affecting temperature changes in foods during canning (*E. S. R.*, 45, p. 560) to a detailed consideration of the relation of initial temperature to exhaust, pressure, and vacuum in the can.

As a guide in the interpretation of the experimental results, the theoretical pressures and vacuums falling within the range of the present work have been calculated. These include theoretical maximum pressure curves for a non-expansible can containing air and a sufficient quantity of water to give saturation when sealed at various temperatures and processed at 100, 109, 116, and 121° C., and theoretical vacuum curves for a noncontractile receptacle containing air and saturated vapor when sealed at various temperatures and cooled to a uniform temperature of 0, 10, 20, 30, and 40°. Both sets of curves are calculated on the basis of the mean barometric pressure. The former curves show that relatively great pressures are developed when the containers are sealed at low temperatures and that as the sealing temperature approaches 100° the pressures fall off with increasing rapidity. The vacuum curves show that the vacuum is increased as the temperature to which the can is cooled is lowered. A can sealed at 70° and subsequently cooled to 20° should give a theoretical vacuum of about 12.3 in., to 30° a vacuum of about 10.9 in., and to 0° a vacuum of 14.3 in.

These theoretical values were compared with actual results obtained with various quantities of distilled water sealed at different temperatures and processed in the retort at 100, 109, 116, and 121°. In all the experimental work the pressure was determined by a special mercury manometer which is described and illustrated, and the temperature by the method described in the previous paper. In the pressure studies with water, it was found that the pressures developed are always below the theoretical. The higher the retort temperature the greater, and the higher the initial temperature the smaller, the variation from the theoretical pressures. Larger cans showed a somewhat greater divergence from the theoretical values than the smaller. The smaller the head-space the less were the experimental pressures obtained. In the vacuum studies with water, at the sealing temperature of 70° and above the

vacuums obtained were below the theoretical, and at the lower temperature slightly above the theoretical values.

The preliminary work with water was followed by detailed experiments with specific food materials, including string beans, peas, tomatoes, corn, and sweet potatoes canned in No. 2 and No. 3 tin cans at different temperatures of sealing and processing. Pressure, vacuum, and heat penetration studies are reported and discussed, including less complete data with spinach. The principal conclusions drawn from this investigation may be summarized as follows:

With food materials in which a free liquid fills the interspaces, the rate of change of pressure and of temperature is very rapid, the temperature quickly reaching a maximum and the pressure continuing to rise as long as the high retort temperatures are maintained. In cans filled with materials of heavy consistency the rate of change of temperature at the center of the can is very slow, and the rate of change of pressure is very rapid at first and becomes slower after the first few minutes. The pressure continues to rise as long as the retort temperature is maintained.

The vacuum developed in tin cans is generally below the theoretical and is determined largely by the temperature of the head-spaces. A short exhaust results in a comparatively high vacuum if the sealing is done immediately. Lower vacuums are obtained where long processing periods and the higher retort temperatures are used.

The resistance of the can to internal temperature is much greater than its resistance to external pressure. In order to reduce the strain due to internal pressure during processing, the sealing temperature should be made as high as possible without danger of collapse of the can in handling after cooling to normal temperature. For most vegetables the optimum temperature for the sealing of No. 2 cans is thought to be from 80 to 85° and for No. 3 cans from 75 to 80°.

Remarks on canning, F. A. NICHOLSON (*Madras Fisheries Dept. Bul.*, 13 (1921), No. 2, pp. IX+35-146).—This bulletin relates almost entirely to the canning of fish as practiced in the Government cannery on the West Coast of India. Of special interest are chapters on the canning of specific fish and jelly fish, including sardines, mackerel, salmon, prawns, oysters, mussels, crabs, lobsters, and smoked fish, and on the preparation of fish pastes.

The preservation of fish frozen in chilled brine.—I, The penetration of salt, L. H. ALMY and E. FIELD (*Jour. Indus. and Engin. Chem.*, 13 (1921), No. 10, pp. 927-930).—With a view to determining whether brine-frozen fish will retain an ice glaze for a reasonable period of time, a study was made of the degree of salt penetration into the skin and superficial tissues of weakfish, flounders, and whiting during immersion for different periods of time in cold brines of different temperatures and concentrations.

It was found that salt penetrates perceptibly under the skin and superficial muscular tissues of the fish under all conditions, but in amounts insufficient to affect the taste of the cooked product. The differences in salt penetration with varying temperature and concentration of brine were found to be insignificant and inconsistent, but fish which had precooled to about 32° F. before immersion in the brine absorbed only about 35 to 65 per cent of the amount of salt absorbed when immersed at ordinary temperature.

The amount and rate of penetration of salt into the tissues was found to vary with the species. In weakfish and flounders the greater part of the salt was absorbed during the first 30 minutes, while in whiting and herring absorption was more gradual. This is thought to be due to inequalities of the fat content of the subcutaneous and body tissues of the fish.

Wheat, flour, and bread. M. K. CORBOULD (*Ohio Sta. Bul. 350 (1921), pp. 185-219, pls. 6, figs. 12*).—The results of an extended study are reported of wheats grown by the station with reference to their comparative value for productiveness and milling and bread-baking qualities.

Under milling qualities the author notes that white wheat produces much bran. "The semihard wheat varieties giving the largest percentage of flour are Gladden, Portage, Trumbull, Ohio 9920, Goens, Nigger, Fulcaster, Ohio 8106, and Deitz. The soft wheat varieties giving the largest percentage of flour are Red Wave, Dawson Golden Chaff, and Gypsy. . . . The flour from the spring wheat is rich in gluten; the hard winter wheat flour has a high gluten content and is suitable for bread baking; the semihard winter wheat flour is recommended for bread baking, cake and pastry making; the soft winter wheat flour is rich in starch, low in gluten, suitable for all baking except bread making, unless blended with a strong flour.

"Twelve tested wheats recommended for their quality are Gladden, Portage, Trumbull, Poole, Goens, Nigger, Fultz, Fultzo-Mediterranean, Valley, Rudy, Mediterranean, and Hickman."

With respect to wheats suited to Ohio conditions the author concludes that "the semihard winter wheats producing good yields per acre and giving general purpose flour—that is, a flour recommended for bread baking, cake, and pastry making—are best for Ohio growers. . . . Spring wheat may be grown in northern Ohio. Ohio-grown seed may be used for seeding spring wheat with good results. The flour may be used for blending with soft wheat flour. . . . The day is past for the farmer to grow wheat for its yield per acre only; the milling and baking quality must be considered."

Wheats damaged by sprouting and mildew were also included in the study to secure data regarding their milling and baking quality and their worth for human consumption. The conclusion reached was that "musty flour, if it can be kept free from odor, may be used for bread making, [or] if badly damaged, for feeding purposes or as a fertilizer. Sprouted wheat has an improved bread-baking quality in the flour, if the plumule has not grown more than the length of the berry."

The influence of relative humidity and moisture content of wheat on milling yields and moisture content of flour. J. H. SHOLLENBERGER (*U. S. Dept. Agr. Bul. 1013 (1921), pp. 12, figs. 6*).—This publication reports the results of an investigation of the influence of the relative humidity of the air within the mill and of the moisture content of various samples of hard wheats when tempered to 15 per cent moisture on the invisible losses occurring during the milling process and on the total yield of mill products. The wheats used in the experiment were milled in a special type reduction machine. The system, although not the same as that employed in commercial mills, included all the steps considered necessary in modern milling practice. The quantity of wheat used in each test was 1,500 gm. (about 3 lbs.). Before milling, each sample was cleaned and scoured, its moisture content determined, and a sufficient amount of water added for tempering to bring the moisture content to 15 per cent. During the tempering period, which ranged from 18 to 22 hours, the samples were kept in air-tight cans to prevent loss of moisture. The samples were then ground in atmospheres of different relative humidity, and the weight of the mill products, moisture content of the flour, etc., determined. Charts are given of the results obtained in the different phases of the study.

The combined effect of the relative humidity of the air and the moisture content of the wheat on the total yield of mill products was found to be a decrease in invisible loss and a proportional increase in total yield with in-

creased humidity. The higher yields were associated with higher relative humidities and with the wheats of lower original moisture content. Each 10 per cent increase in relative humidity above 35 per cent resulted in an average increase of about 0.5 per cent in total weight of the products obtained, and each decrease of 1 per cent in the moisture content of the wheat before tempering resulted in about 0.6 per cent increase in yield.

No very pronounced relation could be observed between the moisture content of the flour and the moisture content of the wheat before tempering. The moisture content of the flour increased with an increase in the relative humidity of the atmosphere, a difference of 10 per cent in relative humidity making an average difference of about 0.5 per cent in the moisture content of the flour.

No definite relation between air temperature and total yield of mill products was established.

Food substitutes and control during the war, A. BEHRE (*Ztschr. Untersuch. Nahr. u. Genussmtl.*, 41 (1921), No. 11-12, pp. 244-259).—This is a summary of various food substitutes that were used in Germany during the war and of the official methods of food control.

A week's food for an average family, C. L. HUNT (*U. S. Dept. Agr., Farmers' Bul.* 1228 (1921), pp. 27, figs. 5).—This publication gives a simple plan by which foods can be chosen for families and compared with a standard as a guide. The series of charts, previously noted (*E. S. R.*, 46, p. 498), is reproduced to show pictorially a sample weekly food supply for a family of three young children and two adults engaged in moderately muscular work—that is, the so-called average family used in discussing statistical and other such problems. The text and other illustrations explain how to generalize from the example chosen, to change the allowance to meet other conditions, and otherwise to use the charts in the home. A table showing the approximate number of hundred-calorie portions in common food materials is included.

The effects of diet on the intestinal flora, P. R. CANNON (*Jour. Infect. Diseases*, 29 (1921), No. 4, pp. 369-385).—To obtain some idea of the quantitative relationship between different types of intestinal bacteria under the influence of different kinds of food, bacteriological studies were made of the feces of white rats on various diets. Identical amounts of fecal emulsions were inoculated into media especially adapted for the growth of the types under investigation. These included Ayers and Rupp agar for *Bacillus coli*, beef liver glucose agar for *B. acidophilus*, lead acetate agar for hydrogen sulphid formers, and sheep brain medium for putrefactive spore-forming anaerobes.

Rats on a stock diet of oats and carrots showed at the end of two weeks a colon-acidophilus (C-A) ratio of 1:99, while rats on a high protein diet, consisting almost exclusively of raw meat, had a C-A ratio of 99:1. Ratios intermediate between the two were obtained by variations in the proportion of protein and carbohydrate foods. Grain foods, lactose, and dextrin led to a marked predominance of aciduric bacteria, while animal proteins led to the predominance of organisms of the gas-producing proteolytic types, both aerobic and anaerobic. The vegetable proteins and certain starchy foods accelerated in many cases a distinct antiputrefactive effect favoring the development of *B. acidophilus* and suppressing the development of hydrogen sulphid-producing organisms and spore-forming anaerobes.

Similar results were obtained in two experiments with human adults, a diet composed of bread, milk, and lactose resulting in an increase in the numbers of the aciduric organisms, and a diet high in vegetable protein also causing predominant aciduric flora with the elimination of anaerobic spores.

Gastric analysis.—IV, The gastric equilibrium zone, C. C. FOWLER, W. H. SPENCER, M. E. REHFUSS, and P. B. HAWK (*Jour. Amer. Med. Assoc.*, 77 (1921),

No. 27, p. 2118, fig. 1).—In continuation of the gastric studies previously noted (E. S. R., 45, p. 666), this paper reports, with an illustrative chart, data on the effect upon the acidity of the normal stomach of the ingestion of fluids of widely different character, including vinegar, tea, hydrochloric acid, sodium chlorid, and sodium bicarbonate in varying concentrations. It was found that the stomach contents assume a strikingly uniform acid concentration within half an hour whatever the nature of the fluid ingested. The area in which the gastric acidity values fall, which varies with different individuals, has been called the gastric equilibrium zone. The mechanism of adjustment to gastric equilibrium is partially or totally lost in disease.

The variation in the content of zinc in the organism of the rabbit during growth, G. BERTRAND and R. VLĂDESCO (*Bul. Soc. Chim. France*, 4. ser., 29 (1921), No. 10, pp. 915–917; also in *Compt. Rend. Acad. Sci. [Paris]*, 173 (1921), No. 1, pp. 54, 55).—Continuing their study of the content of zinc in the animal organism (E. S. R., 45, p. 765), the authors have determined the amount of zinc in rabbits from birth to 6 weeks of age. The results show that the proportion of zinc in the entire body of the rabbit is greatest at birth, diminishes rapidly during the period of lactation, and increases rapidly after weaning. Attention is called to the similarity between this and the iron content of the body, indicating a reserve of both metals sufficient to last during the ordinary period of lactation until the animal is placed on a diet richer in inorganic constituents.

Vitamins and the daily diet, J. W. READ, S. PALMER, and L. STEER (*Arkansas Sta. Bul.* 176 (1921), pp. 3–24).—Information regarding vitamins and their properties, the dietary properties of a number of common foods, and similar questions, is summarized and discussed, and menus are suggested for a young child and for adults. A number of recipes are included.

Some plant sources of vitamins B and C, F. O. SANTOS (*Soc. Expt. Biol. and Med. Proc.*, 19 (1921), No. 1, pp. 2, 3).—Togi (sprouted mungo beans), okra, and avocado are reported to be fairly rich in vitamin B, 0.5 gm. of each daily proving sufficient to cause recovery in weight of rats which had declined on a standard vitamin B-free diet. Mungo beans, sweet potato leaves, and duhat (*Eugenia jambolana*) were less rich in vitamin B, 1 gm. daily of each being required. Artichokes, bilimbi (*Averrhoa carambola*), banana flower bud, and bamboo shoots were relatively deficient in vitamin B.

It is of interest that the vitamin B content of the mungo bean is apparently increased on germination instead of being decreased as has been reported by various investigators to be the case with other beans. Mungo beans proved deficient in vitamin C, while togi (sprouted mungo beans) proved rich in vitamin C.

The effect of temperature and of the concentration of hydrogen ions upon the rate of destruction of antiscorbutic vitamin (vitamin C), H. C. SHERMAN, V. K. LA MER, and H. L. CAMPBELL (*Natl. Acad. Sci. Proc.*, 7 (1921), No. 9, pp. 279–281).—This paper contains, in addition to data which have been previously noted from another source (E. S. R., 45, p. 563), a brief description of the basal ration used in the authors' investigation of the antiscorbutic vitamin. The basal ration adopted consists of ground whole oats 59, heated skim milk powder 30, butter fat 10, and sodium chlorid 1 per cent. Guinea pigs from 6 to 8 weeks old and weighing from 300 to 350 gm. usually eat about 18 or 20 gm. of this ration daily and continue to grow well for about 15 days, then lose weight rapidly, and die of scurvy in from 26 to 34 days from the beginning of the experiment.

The antiscorbutic potency of strawberries, C. A. SMITH, O. BERGEIM, and P. B. HAWK (*Soc. Expt. Biol. and Med. Proc.*, 19 (1921), No. 1, p. 22).—Guinea pigs which had become scorbutic on a diet of oats, milk, and hay were cured

of scurvy within 7 days by the administration of 10 cc. daily of strawberry juice, either fresh or previously boiled for five minutes.

A color reaction common to antiscorbutic extracts and quinol, N. BEZSSONOFF (*Compt. Rend. Acad. Sci. [Paris]*, 173 (1921), No. 10, pp. 466-468).—The author reports that the Folin-Denis phenol reagent, modified by reducing the proportion of concentrated phosphoric acid to one-third the original amount and adding to the mixture (without heating) an equal volume of normal acid (sulphuric, hydrochloric, or nitric), gives a slate gray color turning to blue with various juices of known antiscorbutic properties, such as orange, lemon, tomato, etc., while with extracts of cereals or rape seed the characteristic color is not produced. Prunes did not give the blue color but peaches did. Extracts in which the antiscorbutic vitamin has been destroyed by various means no longer give the color reaction. The author suggests that the reaction is not necessarily due to the antiscorbutic vitamin itself, but to an unstable radical, probably a polyphenol, which in solution detaches itself readily from vitamin C. On applying the test to various phenols quinol alone gave the reaction.

Beriberi-like disease in mammalian animals, M. MURATA (*Japan Med. World*, 1 (1921), No. 2, pp. 12-14).—The author reports that a considerable proportion of rabbits fed polished or unpolished rice, rice straw, and water lose weight and after about 80 days develop paralytic and other nerve symptoms similar to beriberi and die within a few days. On autopsy these animals, as well as others which died without the nerve symptoms, showed general atrophy of the organs, particularly the thymus, pancreas, and the generative organs; hypertrophy of the cortex of the adrenals; and occasionally cirrhosis of the liver. The nerves and muscles of the animals dying with characteristic beriberi symptoms showed retrogressive changes. After the onset of nerve symptoms, recovery following feeding of vitamin-rich food was slower than with pigeons, requiring generally about 10 days.

The author is of the opinion that the beriberi-like disease in rabbits resembles human beriberi rather than avian, in that it is brought about by partial rather than complete lack of vitamin B.

Polished rice disease of birds, C. OGATA, S. KAWAKITA, C. OKA, and S. KAGOSHIMA (*Nisshin Igaku (Prog. Med.)*, 10 (1921), No. 6; *abs. in Japan Med. World*, 1 (1921), No. 2, pp. 23, 24).—In this report of an extensive study of avian polyneuritis, the following results are summarized:

Symptoms identical with those produced by feeding polished rice were produced in pigeons by feeding various carbohydrates, but not by other kinds of food. The paralysis induced by protein feeding was found to be quite different from that induced by polished rice or carbohydrates.

In polyneuritis as distinguished from inanition, loss in body weight was by no means a constant phenomenon until after the onset of polyneuritic symptoms, when the loss of body weight could no longer be controlled. This loss in weight is thought to be due to the radical interruption of metabolism in the final exhaustion of vitamin B in the body and in the food materials. Vitamin B is thus considered to influence the metabolism of carbohydrates. This results in an interruption of digestion caused by the excretion of abnormal substances resulting from the interrupted carbohydrate metabolism.

Other points noted are the absence of evidence of interruption of blood circulation, no abnormalities in the urine with the exception of a slight increase in uric acid salts, a decrease in the erythrocyte and an increase in the leucocyte count of the blood, and an increase in the quantity of blood sugar. In some pigeons a remarkable acidosis occurred, but this was not observed in fowls.

Some recent observations on the nervous lesion in experimentally produced avian polyneuritis (experimental beriberi), F. M. R. W[ALSHE] (*Med. Sci., Abs. and Rev.*, 5 (1922), No. 4, pp. 314-319).—This review, supplementing the one previously noted (*E. S. R.*, 46, p. 330), consists primarily of a criticism of the conclusions of Findlay (*E. S. R.*, 45, p. 768) concerning the nature of the essential lesions in beriberi.

Nature of paralysis in polished rice disease in birds, I, G. KATO and S. SHIZUME (*Keio Igaku (Keio Med. Jour.)*, 1 (1921), No. 1; *abs. in Japan Med. World*, 1 (1921), No. 1, p. 22).—The authors report that avian polyneuritis may be distinguished from simple starvation in that the stimulation velocity of the peripheral nerves, which is from 62 to 63 meters per second in normal birds, is greatly lowered in polyneuritis, in severe cases to about 50 per cent. In starvation, on the other hand, there appears to be no change in the velocity of the transmission of stimulation.

Nature of paralysis in polished rice disease in birds, II, G. KATO, S. SHIZUME, and K. MAKI (*Keio Igaku (Keio Med. Jour.)*, 1 (1921), No. 2; *abs. in Japan Med. World*, 1 (1921), No. 2, pp. 16, 17).—Continuing the above investigation, the authors present the theory, which they claim to have proved experimentally, that the paralysis in polyneuritis is caused by absorption of hydrogen ions, the blood in such cases apparently being saturated with acid.

On the nature of paralysis due to polished rice disease in domestic fowls, G. KATO, S. SHIZUME, and R. MAKI (*Abs. in Kitasato Arch. Expt. Med. [Tokyo]*, 4 (1921), No. 3, pp. 207-216).—Essentially noted above.

Nutrition in Vienna, II, M. G. GIBBON, D. N. PATON, M. FERGUSON, and A. M. T. TULLY (*Lancet [London]*, (1921), II, No. 15, pp. 747-750).—In continuation of the investigation previously noted (*E. S. R.*, 45, p. 562), the authors report a similar study of the nutritive condition of the middle classes in Vienna and of the rural classes in the neighborhood of that city during the same period.

In the first group, in 14 families in which there were cases of rickets the average dietary yield per man per day was 2,049.3 calories, 61.8 gm. of protein, and 50.2 gm. of fat. Similar data for 25 families without rickets were 2,053.5 calories, 58.3 gm. of protein, and 53.5 gm. of fat. Data obtained for the second group for 24 families with rickets were 2,262.1 calories, 63.3 gm. of protein, and 58.2 gm. of fat, and for 23 families without rickets 2,400.8 calories, 78.5 gm. of protein, and 57.3 gm. of fat. The character of the food consumed differed considerably in the two groups, the larger proportion of the country families using fresh milk and butter and the town families margarin and lard.

A comparison of the weight with respect to the age of the children of the three groups studied in this investigation, with the British anthropometric data, shows that the nutrition was least affected during the first two years of life, most markedly affected during the next two years, less affected from 4 to 10 years, and in the case of the town children showed a tendency to become more marked in the period after 10 years.

Rickets occurred in 58 per cent of the working class families, 35 per cent of the middle class families, and 52 per cent of the rural families. The lower incidence of rickets in the second group did not appear to be associated with a greater consumption of milk or other fats. On the contrary, there was a higher intake of milk fat in the third group in which the incidence of rickets was relatively high.

Further studies on the nature of botulinus toxin, J. BRONFENBRENNER and M. J. SCHLESINGER (*Soc. Expt. Biol. and Med. Proc.*, 19 (1921), No. 1, pp. 1, 2).—

Continuing their investigation of the nature of botulinus toxin (E. S. R., 45, p. 769), the authors have found that in the single strain of *Bacillus botulinus* thus far examined for this property an acidity equal to that of the stomach contents actually increases the virulence of the toxin.

Typing of different strains of *Bacillus botulinus* by immunologic methods. J. BRONFENBRENNER, M. J. SCHLESINGER, and S. C. CALAZANS (*Soc. Expt. Biol. and Med. Proc.*, 19 (1921), No. 1, pp. 21, 22).—It has been found impossible to distinguish between the two types of *B. botulinus* by the complement fixation or the precipitation tests, but the agglutination test has given results which agree with those obtained by toxin-antitoxin tests. By means of the agglutination test it is also possible to classify strains of *B. botulinus* which have lost their toxicity under test-tube cultivation.

The thermal death point of the spores of *Bacillus botulinus* in canned foods. H. WEISS (*Jour. Infect. Diseases*, 29 (1921), No. 4, pp. 362-368, fig. 1).—Continuing the botulism studies previously noted (E. S. R., 44, p. 558), the author has determined the thermal death point of the Boise strain of the spores of *B. botulinus* (E. S. R., 42, p. 58) in canned foods under laboratory conditions arranged to approximate as far as possible the conditions in the can. The particular strain of *B. botulinus* used was selected on account of the unusually high heat resistance of its spores. Spores of about a month old and in a concentration of 1,500,000 per cubic centimeter were used in order to have conditions of high resistance. The spore suspension mixed with 9 parts of the fluid to be tested was pipetted in 1 cc. quantities into special glass tubes 10 mm. inside diameter, 12 mm. outside diameter, and 30 cm. long. These were sealed, submerged to a depth of 12 cm. in a De Khotinsky oil bath and exposed to the action of definite amounts of heat for a definite time, after which the contents of the tubes were mixed with 20 cc. freshly heated glucose agar and incubated at 37.5° C. for at least three months. From the data obtained tables have been prepared showing the thermal death point at 100, 105, and 110° of the spores in 36 varieties of canned vegetables and fruits, and of the relation of H-ion concentration of these foods to their thermal resistance.

The results indicate that the two primary factors determining the thermal death points are the H-ion concentration and the physical character of the food. Other factors being equal, foods having an alkaline or an acid reaction require a shorter period of exposure to kill the spores of *B. botulinus* than foods of neutral reaction. Under the given conditions the spores were killed in all food juices (including all the fruits tested) having pH values between 2.1 and 3.85 in 50 minutes or less at 100°. Foods of pH values of 4.22 to 4.44 required from 60 to 90 minutes at the same temperature. Beets, asparagus, wax beans, peas, squash, and sweet potatoes, having pH values of 5.1 to 5.36, required an exposure of 90 to 120 minutes at 100°, while pork and beans, red kidney beans, lima beans, chili con carne, succotash, and sweet corn with pH values of 5.69 to 6.21 required from 150 to 180 minutes at 100°. The greater length of time required for the last two groups was due partly to the consistency of the food material, the less fluid products requiring a longer period of exposure at a given temperature than the more fluid products. The thermal death point was also influenced by the presence and concentration of the sirup, the heavier the sirup the longer being the period of exposure required at any given temperature.

"The temperatures and times of exposure given in this paper must not be directly applied to practical canning, for these factors vary not only with the nature and the pH value of the food in question, but also with the size of the can, the size and compactness of the cook, and the retort technique. Further-

more, a factor of safety should be added to insure sterilization under practical commercial conditions."

Metabolism of Europeans in the Tropics, W. CASPARI and C. SCHILLING (*Ztschr. Hyg. u. Infektionskrank.*, 91 (1920), No. 1, pp. 57-132, figs. 10; *abs. in Chem. Abs.*, 15 (1921), No. 23, p. 4020).—This is a detailed report of metabolism studies conducted on two subjects, first, during a preliminary period in Germany and then in two successive periods on the West Coast of Africa. Data are also included on similar studies on a subject who had lived for some time in Africa. The object of the investigation was a comparison of the utilization of the same food in resting and work periods in temperate and in tropical climates. The data included determinations of nitrogen and fat balance, body temperature, pulse rate, etc. The diets were practically identical, both in calorific and nitrogen content and in the kinds of food eaten.

The data obtained indicated that protein and fat are equally well utilized in both climates, and that the nitrogen balance is maintained in Africa as easily as in the cooler temperature of Berlin. No change in body temperature or pulse rate was noted. Similar results were obtained with the subject who had lived in the Tropics long enough to have become acclimated.

Minimum and basal metabolism of subjects of the white race in the Tropics.—A contribution to the study of acclimatization and the law of surfaces of Rubner-Richet, A. OZORIO DE ALMEIDA (*Jour. Physiol. et Path. Gén.*, 18 (1919), No. 4, pp. 713-730).—In this and the following paper the author uses the term minimum metabolism to signify what is ordinarily known as basal metabolism, and the term basal metabolism as the minimum (basal) metabolism per square meter of body surface calculated by the DuBois formula. The metabolism is determined by indirect calorimetry.

Twenty-six determinations on 10 different subjects gave an average basal metabolism of 30.35 calories per square meter of body surface per hour and a minimum metabolism of 1,290 calories, figures considerably lower than the values obtained in cold and temperate climates. This lowering of metabolism is thought to represent an adaptation to a warm climate and to constitute an advantage in the struggle against high temperatures. Both basal and minimum metabolism vary considerably in normal individuals. These variations are considered to depend upon variations in the habitual metabolism or the total metabolism of the organism, which is in turn dependent upon muscular work, climate, and food. It is thus considered that the amount of heat produced by different individuals submitted to the same conditions depends not only on their body surface (the law of Rubner-Richet) but also upon the habitual intensity of their thermogenesis.

The emission of heat.—The basal and minimum metabolism of negroes in the Tropics, A. OZORIO DE ALMEIDA (*Jour. Physiol. et Path. Gén.*, 18 (1920), No. 5, pp. 958-964).—Similar studies to the above were conducted on 10 negroes of about the same size as the white subjects of the previous study. The average value of the basal metabolism was 32.86 calories, the figure corresponding closely to that of the white subjects. It is thought that the pigmentation of the skin does not play an important rôle in the elimination of heat.

Apparatus used in the estimation of basal metabolism, C. V. BAILEY (*Jour. Lab. and Clin. Med.*, 6 (1921), No. 12, pp. 657-679, figs. 13).—This paper describes in detail an apparatus of the open-circuit type for determining respiratory exchange in man which is in use at the New York Post Graduate Hospital. The particular features of the apparatus, some of which have been described elsewhere (*E. S. R.*, 46, p. 166), are the use of the full-sized gas mask, a special

arrangement of rubber flutter valves, a newly designed gasometer, and a new type of gas sampling bottle, together with several added mechanical features which are considered to lessen the labor of gas analysis. For the calculations the Boothby and Sandiford charts are used (E. S. R., 45, p. 670).

Determination of the basal metabolism from the carbon-dioxid elimination, J. T. KING, JR. (*Bul. Johns Hopkins Hosp.*, 32 (1921), No. 467, pp. 277-289, *pl. 1*).—The measurement of CO₂ elimination instead of O₂ consumption as an index to basal metabolism is suggested, and an apparatus for collecting and weighing the carbon dioxid is described and illustrated. The advantages attributed to this method are that the apparatus is simple and stable, no mathematical calculations are required, and the method is open, thus preventing danger of respiratory infection and proving less annoying to the patient.

To determine the accuracy of the method as compared with oxygen measurements, statistical studies were made upon protocols of two groups of experiments with the Atwater chamber calorimeter. A statistical study by R. Pearl of these figures showed a somewhat higher coefficient of correlation between CO₂ and measured calories (+0.719 and +0.846 in the two series) than exists between O₂ and measured calories (+0.488 and +0.836, respectively).

An analysis of 157 published observations upon gas exchange showed that carbon dioxid is "washed out" in negligible amounts if at all.

It is stated that the practical application of the proposed method has been satisfactory in several hundred observations upon all types of patients, but that the method should not be used in diabetes because of the altered respiratory quotient in that disease.

ANIMAL PRODUCTION.

Normal growth in animals, J. A. MURRAY (*Jour. Agr. Sci. [England]*, 11 (1921), No. 3, pp. 258-274, *figs. 7*).—The object of this article is to investigate the possibility that the rate of growth of animals may, like basal katabolism, be proportional to the two-thirds power of the weight, if the animals are growing but not putting on fat. The rate of growth is known to diminish as the animal increases in size, and it has been assumed that this change is proportional to the weight at any stage. The author expresses this hypothesis by the following formula, in which m is live weight at any time t and a and b are constants to be determined:

$$\frac{dm}{dt} = am^{\frac{2}{3}} - bm$$

An examination of the curvature of graphs constructed from data on the growth of sheep, furnished by the University Farm, Cambridge, convinced the author that $a=1$; hence

$$b = m^{-\frac{1}{3}} - \frac{dm}{dt} \times \frac{1}{m}$$

The value of b as calculated from sheep of different ages was found to be as constant as could be expected by the use of this formula. When the animal reaches maximum size the rate of growth naturally falls to 0. If M equals maximum size (m),

$$M^{\frac{2}{3}} - bM = 0 \quad \text{or} \quad b = M^{-\frac{1}{3}}$$

by substituting for b

$$\frac{dm}{dt} = m \left(\frac{1}{\sqrt[3]{m}} - \frac{1}{\sqrt[3]{M}} \right)$$

Thus if either b or M be known the other can be computed.

This formula after integration did not properly graduate the results, so that it was found necessary to include a correction factor which made the following complete formula for sheep:

$$m^{\frac{1}{3}} = M^{\frac{1}{3}} \left\{ 1 - \frac{\left(1 - \frac{m_0^{\frac{1}{3}}}{M^{\frac{1}{3}}} \right) (1 + .00017 t^2)}{e^{\frac{1}{3} t} \cdot M - \frac{1}{3}} \right\}$$

Tables and graphs are presented showing the weights of sheep calculated by this formula at different ages to agree except for some slight variations with the actual observed weights of the sheep. This formula is then applied to data on growth of chickens and rabbits by the author. The agreement was fairly close in the growth curves, and the chickens especially agreed very closely with the calculated. The following general formula is, therefore, recommended for chickens and rabbits as well as sheep:

$$m^{\frac{1}{3}} = M^{\frac{1}{3}} \left\{ 1 - \frac{\left(1 - \frac{m_0^{\frac{1}{3}}}{M^{\frac{1}{3}}} \right) (K t^n + 1)}{e^{\frac{1}{3} t} \cdot M - \frac{1}{3}} \right\}$$

The constants K and n vary with different types of animals and are difficult to determine. Curves showing the increase in acidity of milk are compared with the growth curves of rabbits and chickens and the similarity is noted. The reason for including curves on the increase in acidity of milk is because acidity in the milk is due to the growth of bacteria and, therefore, is used as a measure of the growth of bacteria.

The growth curves of rats and guinea pigs seem to be similar to the curves of rabbits, but the rate of growth of boys and girls seems to differ widely in that a distinct bimodal curve is formed. The rate of growth in cattle, as determined from inadequate data, points toward a bimodal curve also.

The survival of motility in mammalian spermatozoa. C. G. L. WOLF (*Jour. Agr. Sci. [England]*, 11 (1921), No. 3, pp. 310-322).—These experiments (11) were endeavors to find some solution which will keep mammalian spermatozoa alive and active in order to facilitate artificial insemination. Several solutions were experimented with, but the one giving the best results seemed to be a modification of Tyrode's solution. In preparing this solution, 50 cc. of Tyrode's solution was made by omitting sodium bicarbonate. To this 50 cc. of $M/8$ glucose solution was added. To 95 cc. of this sugar Tyrode solution were added 0.5 cc. of $M/5$ NaH_2PO_4 and 1.8 cc. of $M/5$ Na_2HPO_4 . A rapid stream of oxygen was then passed in at 0° C. for 30 minutes, and 0.04 gm. of dry sodium bicarbonate was added to the solution and gently stirred in. The pH of this solution when cold was 7.4. The spermatozoa were added to the cold solution and the tube packed in ice. The cells were still in a state of motility after 216 hours when preserved in this way. Rabbits' spermatozoa were used for the work. Insemination experiments by the author with the preserved spermatozoa seemed to be unsuccessful.

On the elimination of the X-chromosome from the egg of *Drosophila melanogaster* by X-rays. J. W. MAJOR (*Science*, n. ser., 54 (1921), No. 1395,

pp. 277-279).—Sixteen homozygous red-eyed females of *D. melanogaster* were X-rayed just after emerging from the pupa with an X-ray dose just under the sterilization dose. Nineteen full sisters of the above females were used as controls and were not X-rayed. When these females were mated to white-eyed males none of the 19 control females produced white-eyed males, whereas 12 of the 15 fertile rayed females (one proved sterile) produced 1 or more white-eyed males. Of 2,460 males and females produced by the 15 rayed females, a total of 20 white-eyed males occurred.

In another experiment 7 red-eyed sister females were used. Of these 3 were saved as controls and 4 were X-rayed. When mated with white-eyed males 1 of the control females produced 1 white-eyed male, whereas 2 of the rayed females produced white-eyed males, 1 producing 3 and the other 1.

The chance of the white-eyed males occurring in the rayed groups by non-disjunction is discussed, but is thought by the author to be hardly possible. This then would have to be a distinct case of modification of the X-chromosome by the X-ray. The other chromosomes of the rayed females do not seem to be affected, as some of the parental white-eyed males were "dumpy," whereas the F_1 white-eyed females were all normal winged except 1 which died before the wings expanded. Since the X-chromosomes seem to behave in maturation different from the other chromosomes, it is possible that the X-chromosomes may be acted upon by the X-ray with no action on the other chromosomes.

[Work in animal husbandry at the Oregon Station] (*Oregon Agr. Col. Bul.* 297 (1919), pp. 10, 28).—In a brief statement regarding the different lines of feeding work pursued by the station, it is briefly noted that, according to results secured at the station, oat hulls can be used as a substitute for hay in feeding cattle and horses, and salvaged grains from dock fires for feeding hogs. It was found that the value of oat hulls was approximately halfway between oat straw and good hay, and that 1 ton of oat hulls supplemented with 100 lbs. of linseed oil meal or cottonseed meal is equivalent approximately to 1 ton of good vetch hay. Pigs consumed a full ration composed of 40 per cent salvaged grain and 60 per cent barley. The station reports as having demonstrated the greater value of barley as compared with wheat in pork production and of chopped alfalfa hay as compared with long hay in feeding cattle.

Cassava [as a stock feed] (*Hawaii Sta. Rpt.* 1920, pp. 60, 61).—In feeding trials with dairy cattle and hogs cassava meal, when fed in equal portions with corn, was found to have a feeding value equal to corn.

When cassava was fed in the fresh state as 50 per cent of the ration (dry matter basis) it produced scours in dairy cows and pigs, and lowered the milk flow of the cows about 20 per cent. Fresh cassava fed at the rate of 25 and 35 per cent of the ration (calculated on dry matter basis) was found equal to corn or wheat middlings in feeding value.

No poisoning in swine has been reported in this district, though large amounts have been fed as fresh, sliced roots or as pasturage.

Feeding experiments with *Solanum opacum*, M. HENRY and F. WHITEHOUSE (*Agr. Gaz. N. S. Wales*, 32 (1921), No. 10, pp. 741, 742).—Because of the common belief that nightshade is poisonous to stock, several pigs and three sheep were fed berries of *S. opacum* without injurious effects.

Inspection of commercial feeding stuffs, H. R. KRAYBILL, T. O. SMITH, and C. P. SPAETH (*New Hampshire Sta. Bul.* 200 (1921), pp. 43).—The operation of the State law regarding commercial feeding stuffs and the meaning and value of commercial analysis are discussed, and the different types of animal foods are defined. The results of the analysis of 246 samples, together with the ingredients of the different feeding stuffs as certified by the manufacturers, are given in a table. The following materials are included: Alfalfa meal,

dried beet pulp, brewers' dried grains, cottonseed meal, linseed meal, hominy, corn gluten feed, oat feed, rye middlings, wheat bran (with and without screenings), wheat mixed feed, standard and flour wheat middlings, red dog flour, meat scrap, and a variety of compounded feeds.

Commercial feeding stuffs, B. YOUNGBLOOD ET AL. (*Texas Sta. Bul.* 281 (1921), pp. 5-204).—A copy of the Texas feed law with advice for complying with it is given. The standards and definitions for various feeding stuffs are also presented. Analyses of samples of feeding stuffs collected during the year ending August 31, 1921, are tabulated alphabetically according to the manufacturers. The materials include alfalfa meal, chopped alfalfa, barley chop, brewers' dried grains, dried beet pulp, condensed buttermilk, corn bran, corn meal, ground corncob and husk, ear corn chop (with and without husks), corn gluten feed, hominy feed, cold pressed cottonseed, cottonseed feed, cottonseed meal, cottonseed cake, kafir chop, kafir head chop, kafir meal, linseed meal, milo chop, milo head chop, milo meal, oat chop, ground oats, rolled oats, ground peanut hay with nuts, cracked peanut cake, peanut oil meal, rice bran, cracked rice, rice polish, Sudan grass seed screenings, cracked wheat, wheat bran (with and without screenings), brown, gray, and white wheat shorts (with and without screenings), wheat mixed feed (with and without screenings), red dog flour, meat scrap, tankage, and a variety of proprietary mixtures.

International trade in live stock and their products (*Commerce International du Bétail et de ses Dérivés*. Rome: *Inst. Internatl. Agr.*, 1921, pp. 140).—Part 1 is a tabulation of the exports and imports by the different countries of the following products by years from 1915 to 1919, inclusive: Horses, asses, mules, camels, cattle, sheep, goats, swine, beef, mutton, pork, frozen meat, canned meats, animal fats, lard, milk, butter, cheese, hides, leather, and wool. Part 2 indicates where the products imported came from and where the exports of each country went for the years 1915 to 1919, inclusive.

Feeding experiments with grade beef cows raising calves, E. W. SHEETS and R. H. TUCKWILLER (*U. S. Dept. Agr. Bul.* 1024 (1922), pp. 17, figs. 8).—The plan and method of the experiment are outlined, the results secured are given in tables, and the relative value of the rations fed as to gains and cost is discussed. Feeding trials in cooperation with the West Virginia Experiment Station were conducted in southeastern West Virginia for four years during an average winter period of 132 days with grade Shorthorn, Hereford, and Aberdeen Angus cows, averaging 834 lbs. in weight, and generally bred to calve in the spring or early summer. For each feeding period the cows were divided into four uniform lots of ten each, and in summer the cows and their calves were pastured on about 120 acres with a good growth of bluegrass and white clover. After the first year the fourth lot fed shock corn, mixed hay, and wheat straw was discontinued on account of the higher cost and lower feeding value of the ration as compared with those containing silage. The composition of the feeds used, excepting cottonseed meal, as analyzed and tabulated, was somewhat below the average. The mixed hay fed was approximately half timothy and half clover.

The average results for the four years showed that the cows of lot 1, consuming each daily 23.1 lbs. of corn silage, 7.8 lbs. of mixed hay, and 2.6 lbs. of wheat straw, lost 4 lbs. per head during the winter feeding period, those of lot 2, consuming daily 24.1 lbs. corn silage, 7.4 lbs. soy bean hay, and 2.2 lbs. wheat straw gained each 47 lbs., and those of lot 3, eating daily 24.3 lbs. corn silage, 1.5 lbs. cottonseed meal, and 7.2 lbs. wheat straw, gained each 20 lbs. The cows of lot 4 under trial only one year consumed 15 lbs. shock corn, 10 lbs. mixed hay, and 1.8 lbs. wheat straw, and lost 49 lbs. per head. The lots losing weight in winter made the greater gains during the following summer, but the

lots maintaining their weight in winter made the greater gains for the whole year. Basing the value of the different rations on the average birth weight of the calves and on the gains in weight made by the cows during both summer and winter periods, the ration of lot 2 ranked first, that of lot 3 second, and that of lot 1 third.

The tabulated results of a study of the cost of the rations and of raising the calves to weaning age showed that corn silage and wheat straw with either mixed hay, soy bean hay, or cottonseed meal is a much cheaper ration than shock corn, mixed hay, and wheat straw for wintering grade beef cows.

Home-grown feeds for range steers, F. A. HAYS (*Wyoming Sta. Bul.* 128 (1921), pp. 53-75, fig. 1).—This bulletin reports the results of experiments with home-grown feeds for wintering and fattening steers, and cites briefly the results of a number of similar feeding trials by different experiment stations and also by feeders mainly in the western part of the country. The chemical composition and the digestion coefficients of most of the feeds used are given in tables.

Several feeding trials were made with the same lot of 36 steers, beginning when they were yearlings and divided into four equal groups. In the first trial, which lasted 84 days, group 1, the check group, received a full feed of native hay, group 2 received the same weight of alfalfa hay, group 3 half the quantity of native hay and all the sunflower silage it would consume, and group 4 half of the feed of native hay and the same weight of oat and pea silage as was consumed by group 3 of sunflower silage. In the second trial, in progress from April 20 to May 25, all groups were fed hay and silage. Groups 1 and 2 received a half feed, or 10 lbs. of alfalfa hay and 30 lbs. of silage, while groups 3 and 4 received 5 lbs. of alfalfa hay and 40 lbs. of silage. Groups 1 and 4 received oat and pea silage and groups 2 and 3 sunflower silage.

The results secured indicated that yearling steers can be wintered economically on 10 lbs. of native hay and 25 lbs. of either oat and pea or sunflower silage per head per day. In these tests 1 ton of either silage replaced about 1,400 lbs. of native hay. The yearlings given a half feed of native hay and a full feed of either the one or the other silage made an average daily gain of 1.25 lbs. each, while those on alfalfa hay alone made 0.75 lb. and those on native hay alone 0.91 lb. of gain per day. The silage-fed groups presented the better finish.

The 36 steers kept on 640 acres of upland pasture from May 29 to November 1 made an average daily gain of 1.09 lbs. per head.

An experiment in fattening these same steers was conducted from December 10 to March 18, the steers being again divided into equal and uniform groups. Group 1 received a full feed of native hay and about 2.5 lbs. of cottonseed meal each, group 2 the same amount of native hay and linseed meal equal in quantity to the cottonseed meal fed group 1, and groups 3 and 4 received half the amount of native hay and the same allowance of cottonseed meal consumed by group 1, together with a full feed of sunflower silage made from frosted plants which reduced it to some extent in value.

The results in this test indicated the superiority of cottonseed meal over old process linseed meal. The use of silage in such large quantities as half the roughage on a dry matter basis was not as economical as native hay and cottonseed meal alone. The feeding of silage did not seem to affect the condition of the cattle or their shrinkage in shipment.

Lamb experiments (*Ontario Agr. Col. and Expt. Farm Ann. Rpt.*, 45 (1919), p. 22).—In the fall of 1918, 8 ram lambs, 8 ewe lambs, and 8 wether lambs were fattened. The ram lambs lost more during shipment and brought less per pound than either of the other lots.

A score card for wool, J. A. HILL and S. BRAY (*Natl. Wool Grower*, 12 (1922), No. 2, pp. 15, 16).—The authors present a score card for wool which has been worked out according to their ideas.

Errors in feeding experiments with crossbred pigs, R. A. BERRY and D. G. O'BRIEN (*Jour. Agr. Sci. [England]*, 11 (1921), No. 3, pp. 275-286, figs. 2).—These experiments were carried on in 1912 with 43 crossbred pigs and in 1913 with 46 crossbred pigs. The purpose of the experiment was to study the probable error that was likely to occur in the rate of fattening pigs. The experiments lasted 16 weeks each year, during which time weights were regularly taken, and tables are presented showing the initial weight of each pig and also the average daily gain. Different factors such as number of pigs, sex, initial weight, breeding, duration of experiment, and stage of fattening are discussed with relation to their effect and the probable error.

The authors conclude that the rate of fattening of pigs is very variable. The probable error on one pig calculated on the average daily live-weight increase was found to be about 7 per cent for crossbred pigs. This was markedly reduced, however, when the pigs were of the same size and breeding. The results of other papers on errors in feeding experiments are mentioned, these having been previously reported (E. S. R., 24, p. 633; 28, p. 268; 29, p. 170; 33, p. 871).

Feeding farm work horses and mules, J. L. EDMONDS and W. G. KAMMLADE (*Illinois Sta. Bul.* 238 (1922), pp. 409-427, figs. 2).—Four feeding experiments were conducted with two horse and two mule teams, including at the beginning a team of 10-year-old mares and one of 4-year-old geldings and a team each of mare and horse mules, 5 and 6 years old, respectively. In the second experiment three 5-year-old geldings replaced two mares and one gelding of the first experiment, and in the third experiment a 5-year-old gelding replaced one of those used previously. There were no changes in the fourth trial with horses, and the same mules were used throughout the four experiments.

Grain and hay were fed in quantities readily consumed by the animals. The grain fed in the first three experiments consisted of two-thirds corn and one-third oats, and in the fourth experiment of ear corn. In the first experiment clover hay was fed, in the second one-half clover and one-half timothy hay, in the third alfalfa hay or one-half alfalfa and one-half timothy hay, and in the fourth alfalfa hay. The relation of the rations fed to the modified Wolff-Lehmann standards for horses at medium work and of the corresponding weights of the horses and mules used is pointed out. In the second experiment, in progress from April 27 to September 14, the labor record was reduced by one of the horses being subject to attacks of colic. The results of the experiments are summarized in the following table:

Summary of feeding experiments with farm work horses and mules.

Year.	Period.	Grain per head per day.	Hay per head per day.	Labor per work day.	Distance traveled.	Average weight.	
						Begin- ning.	Close.
Horses:	<i>Days.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Hours.</i>	<i>Miles.</i>	<i>Pounds.</i>	<i>Pounds.</i>
1912.....	364	18.13	14.43	8.02	2,782	1,445	1,585
1913.....	140	16.11	14.60	8.25	1,259	1,578	1,566
1914-15.....	364	18.03	16.93	8.07	.....	1,621	1,626
1916-17.....	364	15.77	18.75	8.07	2,960	1,636	1,666
Mules:							
1912.....	364	14.16	13.54	8.06	2,863	1,337	1,428
1913.....	140	12.00	11.62	8.69	1,451	1,401	1,374
1914-15.....	354	13.20	13.66	8.43	.....	1,349	1,315
1916-17.....	364	11.50	16.40	8.25	3,000	1,290	1,343

In the 1914-15 experiment the average gain in weight of 6 lbs. was due to a gain of 75 lbs. by one horse. Two of the horses lost 25 lbs. each and the fourth neither gained nor lost.

The recommendations, based on the results of these feeding trials, are to the effect that home-grown feeds should be used, and that a legume hay fed along with ear corn or preferably ear corn and oats should be made an important part of the roughage. As a general rule it is suggested that approximately 1 lb. each of grain and forage per 100 lbs. live weight per day be fed, increasing the grain when the work is hard and decreasing the grain and increasing the roughage when the work is light or the animals are idle. While it was found that alfalfa hay and ear corn are sufficient to maintain horses and mules doing a considerable amount of medium to hard work, it is believed that part of the alfalfa or clover roughage may be replaced with timothy hay, oat hay, oat straw, prairie hay, or corn stover, and one-third of the corn ration may be replaced with oats to good advantage.

Data with reference to cost of feed and the record of each individual animal are shown in tables.

The effects of feeding Sudan grass to stock, S. T. D. SYMONS (*Agr. Gaz. N. S. Wales*, 32 (1921), No. 11, pp. 791-795).—A number of horses were reported sick and some died from what was said to be the effects of Sudan grass pasture. Four experiments were carried on in which horses were fed on Sudan grass (2 horses as long as six months). These experiments seemed to disprove the possibilities of injurious effects of Sudan grass, as no fatalities were reported.

Extra lights in laying pens (*Ontario Agr. Col. and Expt. Farm Ann. Rpt.*, 45 (1919), pp. 29, 30).—The birds used in this test were pullets and yearlings of the Barred Rock and White Leghorn breeds, grouped according to age and breed. The birds with lights laid more eggs during the winter months, but the results of the yearly productions were not any better.

Sanitary practices on the poultry plant, W. C. THOMPSON and G. W. HERVEY (*New Jersey Stas., Hints to Poultrymen*, 10 (1922), No. 4, pp. 4, fig. 1).—Brief notes are given on the cleaning of poultry houses, yards, and feeding utensils, the value of fresh air and sunlight in flock management, the handling of poultry manure, and the use of poultry tonics.

DAIRY FARMING—DAIRYING.

Feeding of cake to milch cows on pasture (*Olympia Agr. Co. Ltd., Research Dept. Ann. Rpt.*, 1 (1921), pp. 76-80).—This is the report of an experiment to test the effect on the yield of milk of withholding undecorticated cotton cake from milch cows during the grazing season. Sixteen grade Shorthorn cows were selected on May 30, 1920, and divided into two lots nearly equal as regards milk yield and period of lactation. Lot A received 4 lbs. of cake per head per day, whereas lot B received no cake after June 6. After August 8 the lots were shifted so that lot A received no cake and lot B received cake.

Results of feeding undecorticated cotton cake to milch cows.

Lot.	Average time in milk to May 30.	Average milk production per cow per week.			
		Five weeks before May 30.	June 20 to July 25.	Four weeks during August.	Four weeks during September.
	Weeks.	Pounds.	Pounds.	Pounds.	Pounds.
A.....	23.2	162.33	166.1	136.6	110.4
B.....	22.2	161.78	166.5	139.2	123.5

Results indicate that the cake had no measurable effect on the milk yield until early August, after which the effect increased until the end of the summer.

[Feeding bananas to milch cows], J. E. GAMALIELSON (*Hawaii Sta. Rpt. 1920, p. 66*).—In an experiment on the farm of a collaborator the milk yield of one cow was increased by the feeding of 10 bananas in the evening. The estimated increase of milk was valued at 0.75 to 1 ct. for each banana. The feeding of 20 bananas proved too much and resulted in the cow going off feed and a drop in milk flow. Two other cows gave similar results.

The best results in feeding were obtained if the bananas were sliced when firm and a little bran or middlings sprinkled over them.

Some problems of the milk industry, G. LEIGHTON (*Highland and Agr. Soc. Scot. Trans., 5. ser., 33 (1921), pp. 180-229*).—The author surveys some of the more important problems of the milk industry in Scotland, suggesting the advantages of placing the laws governing production, distribution, and the sale of milk under a single milk act.

British Columbia dairy farm survey, H. R. HARE (*Brit. Columbia Dept. Agr., Dept. Circ. 36 (1921), pp. 12*).—The object of this survey, on 54 farms from May 1, 1919, to April 30, 1920, was to determine the factors which make for profit and loss on dairy farms in British Columbia. It was found that while good crop yields are essential to good returns, high quality live stock had a greater effect in raising labor incomes. The cost of producing butter fat was lower where purebred sires were used, and it was lowest where they had been used longest.

Milk recording societies and their effect upon the dairy farming industry, J. MACKINTOSH (*Jour. Farmers' Club [London], 1922, pt. 1, pp. 22*).—The author reviews the advantages which are coming in England through the work of the milk recording societies. Not only is it found desirable to know the individual cow's production, but the percentage of butter fat in the milk and the feed which the cow eats are important. Tested cows are bringing much higher prices, and testing is a stimulation for better herd and farm management.

Milk records, W. STEVENSON (*Highland and Agr. Soc. Scot. Trans., 5. ser., 33 (1921), pp. 244-260*).—This is an account of the milk recording done during 1920 in Scotland under the direction of the Scottish Milk Record Association, embracing 37 local societies comprising 587 members and 24,023 cows.

The feed cost of producing butter fat, H. A. ROSS (*Creamery and Milk Plant Mo., 10 (1921), No. 12, pp. 27-29, figs. 2; Butter, Cheese, and Egg Jour., 13 (1922), No. 11, pp. 14, 16-18, figs. 2*).—The data for this paper were derived from Illinois Experiment Station Bulletin 224, previously reported (E. S. R., 42, p. 563). These data, which were obtained in 1918 as to the amount of feed required to produce a pound of butter fat, have been taken by the author, and 1919, 1920, and 1921 prices have been applied to them. In this way a comparison has been made to show the difference between feed cost and butter fat prices for those years.

Seasonable variation in butter-fat content of milk in southern Arizona, R. W. CLOTHIER (*Soc. Prom. Agr. Sci. Proc., 39 (1919), pp. 75-112, figs. 4*).—The author presents data on the monthly butter-fat percentage of the milk from 285 Arizona herds. Some seasonal variation is evident, the fat percentage being highest during January and lowest during March and April. The explanation of this is that the feeds differ at those times of the year. During the summer months the cows receive only alfalfa pasture, whereas during the winter months they receive alfalfa hay and barley pasture.

An experiment is also cited in which the butter-fat percentage in milk was raised from 2.98 to 3.48 per cent by feeding cottonseed meal. Since these re-

sults are contradictory to much experimental evidence, the author thoroughly reviews and discusses the literature dealing with the possibilities of varying the fat percentage in milk by the feeding of different feeds. A bibliography of 100 references is included.

Effect of lactation period on percentages of fat and solids-not-fat in milk (*Ontario Agr. Col. and Expt. Farm Ann. Rpt.*, 45 (1919), pp. 23, 24).—Records of weekly tests for butter fat and solids-not-fat in the milk from 9 cows indicate that the percentage for both fat and solids is high at the beginning of lactation and gradually drops until just before the end of lactation, when the solid's-not-fat increase. Individual cows vary, however.

A method for determining lime in dairy products, T. MOJONNIER (*Jour. Dairy Sci.*, 4 (1921), No. 5, pp. 453-455).—The author gives an account of a rapid method of determining the lime content of all dairy products except those containing large amounts of sugar.

Researches on vitamin A.—VII, Notes on the factors influencing the value of milk and butter as sources of vitamin A, J. C. DRUMMOND, K. H. COWARD, and A. F. WATSON (*Biochem. Jour.*, 15 (1921), No. 4, pp. 540-552, figs. 3).—This article, abstracted elsewhere (*E. S. R.*, 46, p. 357), deals mainly with factors which influence the vitamin A content of butter.

Butter (*Ontario Agr. Col. and Expt. Farm Ann. Rpt.*, 45 (1919), p. 24).—The results of pasteurizing sour cream at temperatures of 140, 150, 160, 170, and 180° F. with and without culture and also with and without adding lime neutralizer are reported. The higher the temperature the more fat there was lost in the buttermilk, but the lime neutralizer tended to lessen the loss. Cream which was heated to 170° produced the best butter. No change was noted by the use of the culture. The neutralized lots kept better in storage, but there was no difference in the fresh butter. It was found better to "overwork" butter than to "underwork" it.

Testing buttermilk, J. W. MITCHELL (*N. Y. Prod. Rev. and Amer. Creamery*, 53 (1922), Nos. 15, pp. 666, 668; 16, pp. 733-738).—Due to the inaccuracy of the Babcock test for testing buttermilk, the American Association of Creamery Butter Manufacturers has worked out a test which seems to check closer with the chemical analysis than the Babcock test. The regular Babcock glassware is used, and for the test 2 cc. of *n* butyl alcohol is added to the bottle, followed by 9 cc. of buttermilk, and then from 7 to 9 cc. of commercial sulphuric acid. It is then centrifuged 6 minutes, then 2 minutes, and then 2 minutes according to the rules for making the Babcock test.

By using this new test for buttermilk at different creameries, the following factors were found to decrease the fat lost in buttermilk: (1) A good quality of cream, (2) a churning temperature sufficiently low that it will take 45 to 50 minutes to churn, at the speed to produce the greatest concussion, with the churn one-third to one-half full, and (3) holding the cream at least two hours at churning temperature before churning.

Cheese experiments (*Ontario Agr. Col. and Expt. Farm Ann. Rpt.*, 45 (1919), pp. 25-27).—The following experiments are reported:

Rennet v. mixtures of rennet and pepsin.—The cheese made with rennet (3 oz. per 1,000 lbs. of milk) scored slightly higher than cheese made with rennet and pepsin (1.5 oz. of rennet and 2 oz. of pepsin).

Effect of acidity of milk on rennet and pepsin solutions.—Tests were made with milk of 0.18 and 0.19 per cent acidity. The higher acidity favored more rapid coagulation, but was not any better for the pepsin than for the rennet solution as determined by the yield and the quality of the cheese.

Effect of increased temperature of the milk at the time of adding rennet and pepsin.—In milk averaging 0.19 per cent acidity, 3 oz. of rennet to 1,000 lbs.

of milk at 86° F. averaged 88.66 lbs. of cheese, whereas 2.5 oz. of rennet to 1,000 lbs. of milk at 90° averaged 89.02 lbs. of cheese.

Effect of paraffining cheese on shrinkage and quality, held in ordinary curing room and ice-cold storage.—Less weight was lost by cheese in storage which had been paraffined than by similar cheese in storage which had not been paraffined. The average score of the paraffined cheese was a little higher except in case of the small flat cheese kept in ice storage, when the reverse was true.

Methods of calculating ice cream mixes, H. H. SOMMER (*Jour. Dairy Sci.*, 4 (1921), No. 5, pp. 401-415).—Formulas partially based on "Pearson's Square Method" are proposed whereby it is possible to compute the amount and the character of each ingredient to be used in making complex ice cream mixes of a definite percentage of fat and total solids. The formulas in themselves are rather complicated, but the author states that it is only necessary to go through the entire calculation when using new recipes.

Ice cream standards in Wisconsin, H. KLUETER (*Creamery and Milk Plant Mo.*, 11 (1922), No. 3, pp. 66, 68, 70, 72).—The author gives the text of the standards for ice cream adopted by the State of Wisconsin, effective July 1, 1921..

Processing evaporated milk, W. D. BIGELOW (*Canning Age*, 1922, Feb., pp. 11-13, figs. 4).—The author reports experiments in sterilizing evaporated milk, in which it was found that the temperatures and the length of time for sterilization should be absolutely accurate, as 6½ minutes at 250° F. was found equivalent to 20 minutes at 240° for the specific bacteria which were worked with. This shows that a slight variation in temperature means a considerable variation in the time required for sterilization.

VETERINARY MEDICINE.

Essentials of veterinary physiology, D. N. PATON and J. B. ORR (*Edinburgh: W. Green & Son, Ltd.*, 1920, 3. ed., rev. and enl., pp. XIX+674 figs. 246).—This is the third edition of a work first published in 1905. It gives the essentials of general and special physiology of the domestic animals and is intended for use by students and practitioners of veterinary medicine.

Special pathological anatomy of domestic animals, E. JOEST (*Spezielle Pathologische Anatomie der Haustiere. Berlin: Richard Schoetz*, 1919, vol. 1, pp. VI+740, figs. 312; 1920, vol. 2, pt. 1, pp. 464, pls. 2, figs. 173).—The first volume of this work deals with the mouth and buccal cavity, including the glands and teeth, the esophagus, the rumen (of ruminants), the stomach, and the intestine. The second volume deals with the liver and bile duct, the pancreas, and the peritoneum.

Annual report of the director of animal industry for the year ended November 30, 1920, L. H. HOWARD (*Mass. Dept. Conserv., Dir. Anim. Indus. Ann. Rpt.*, 1920, pp. 60, figs. 4).—This report deals with the occurrence of infectious diseases of live stock and control work conducted during the year. Tables and charts are presented showing the occurrence of bovine tuberculosis since 1902, glanders since 1900, rabies since 1905, and hog cholera since 1914.

A simple method for anaerobic cultivation in Petri dishes, S. MORSE and N. KOPELOFF (*Amer. Jour. Pub. Health*, 12 (1922), No. 2, pp. 119-121, figs. 3).—The method requires the use of two tops or two bottoms of Petri dishes. In one of these the culture medium is poured, allowed to solidify, and streaked in the usual way. In the other dish are placed from 5 to 10 gm. of dry powdered pyrogalllic acid and about 30 cc. of a 5 per cent solution of sodium hydroxid. The dish containing the culture medium is quickly inverted over the other dish

and the two sealed together by means of adhesive plaster. The "capsule," as it is called, is then incubated as an ordinary aerobic plate.

Anthrax prophylaxis in the leather industry, A. SEYMOUR-JONES (*Jour. Amer. Leather Chem. Assoc.*, 17 (1922), No. 2, pp. 55-65).—This is a paper presented to the division of leather chemistry at the meeting of the American Chemical Society at New York, in September, 1921.

Johne's disease and its detection, B. A. BEACH and E. G. HASTINGS (*Jour. Infect. Diseases*, 30 (1922), Nov. 1, pp. 68-79).—Following a brief discussion of the nature and distribution of Johne's disease, a report is given of an investigation of the disease at the Wisconsin Station, including attempts at isolation of the organism, the preparation of diagnostic johnin, its application in a number of herds, and the confirmation of the test by constitutional reactions, retests on reacting animals, and macroscopic and microscopic post-mortem examination of reactors.

In one herd, which was known to have been infected for 14 years previous to the time the work was begun, 7 tests were made at intervals of from 3 to 6 months from June, 1917, to December, 1920. The number of reactors found in the successive tests were 5, 4, 6, 3, 4, 4, and 2. On repeating the test in June, 1921, no reactors were found, but it is not deemed at all certain that additional reactors will not be found in future tests. The specific organism was found in all but 1 of the 28 animals reacting to johnin, thus showing the reliability of the test when positive.

Observations of the spread of the disease in several herds indicate that the disease at times spreads very rapidly and at other times very slowly.

Relapsing fever in Panama: The human tick, *Ornithodoros talaje*, demonstrated to be the transmitting agent of relapsing fever in Panama by human experimentation, L. B. BATES, L. H. DUNN, and J. H. ST. JOHN (*Amer. Jour. Trop. Med.*, 1 (1921), No. 4, pp. 183-210, figs. 4).—This is a report of investigations conducted by the authors at the Board of Health Laboratory and Ancon Hospital, Canal Zone.

In the course of the work two white rats were infected with relapsing fever by inoculating them with a suspension of macerated naturally infected *O. talaje* Guer.-Men. ticks. Typical spirochaetes were found in naturally infected ticks in Panama. One *Macacaeus rhesus* monkey was infected with relapsing fever of Panama by feeding a number of *O. talaje* larvae upon an infected white rat, and 22 days later allowing the same ticks as first stage nymphs to feed upon the monkey.

Three human volunteer patients were infected with relapsing fever, as follows: "The first by a subcutaneous injection of blood from a white rat which had been infected with relapsing fever by a combined subcutaneous and intraperitoneal injection of naturally infected ticks, the second by a hypodermic injection of a suspension of naturally infected ticks, and the third through the bite of naturally infected ticks." Thus it has been proved by human experimentation that *O. talaje* transmits the causative agent of relapsing fever in Panama.

Intravenous injections of virulent blood in the hyperimmunization of animals vaccinated against rinderpest, E. NICOLAS and P. RINJARD (*Compt. Rend. Soc. Biol. [Paris]*, 85 (1921), No. 22, pp. 82-85).—An experience in the hyperimmunization of cattle in the preparation of immune serum for rinderpest is reported, which shows the dangers involved in the repeated intravenous injections of virulent blood.

Six animals immunized against rinderpest were injected at varying intervals of from 7 to 53 days after immunization with virulent blood freshly received and citrated. The first and the two following injections at 3 and 7

day intervals caused no reaction. Following the fourth injection, 6 days after the third, symptoms resembling anaphylaxis were observed in 4 of the 6 animals, 1 with fatal results. The 5 remaining animals received another injection after an interval of 2 days. This injection caused a violent anaphylactic reaction in 2 cases, neither of which was fatal, although in 1 case bleeding was resorted to before the symptoms were relieved.

In commenting on these results, attention is called to the direct transfusion method suggested by Van Saceghem (*E. S. R.*, 45, p. 883). It is thought that the impossibility of determining the exact volume of blood introduced is a serious objection to this method.

Vaccination against rinderpest, R. VAN SACEGHEM (*Compt. Rend. Soc. Biol. [Paris]*, 85 (1921), No. 32, pp. 878, 879).—In place of the usual serum simultaneous method of inoculating cattle against rinderpest, the author recommends the preliminary inoculation of three feeble doses of virus, followed on the second day of the fever induced by this inoculation by an injection of 50 cc. of the serum in the jugular vein.

Rinderpest ("peste bovina") in Brazil, G. A. ROBERTS (*Jour. Amer. Vet. Med. Assoc.*, 60 (1921), No. 2, pp. 177-185).—This is an account of the successful control of an outbreak of rinderpest which took place at Osasco, just outside of the city of Sao Paulo, in the early part of 1921. By quarantining the known infected and neighboring territory, containing some 30,000 animals, the disease was brought under control. The last case was reported on May 23, and restrictions were removed on August 26. Approximately 600 animals died from the disease, and about 1,000 were slaughtered.

Studies on the influence of H-ion concentration on the growth and toxin formation of tetanus bacilli, K. G. DERNBY and B. ALLANDER (*Biochem. Ztschr.*, 123 (1921), No. 5-6, pp. 245-271, figs. 4).—With other factors kept under careful control, a study was made of the optimum H-ion concentration for growth and toxin formation of tetanus bacilli. The zone favorable to growth was found to be comparatively broad, from pH=5 to pH=8.5, the optimum lying between 7 and 7.6. The stability zone of the toxin lay between pH=5.8 and pH=8, the optimum lying between pH=6 and 7.5. For maximum production of tetanus toxin it is considered that the pH value of the medium should be not less than 6.8.

The epidemic and epizootic significance of the different types of the tubercle bacillus, E. C. SCHROEDER (*Jour. Amer. Vet. Med. Assoc.*, 59 (1921), No. 4, pp. 434-442).—This is a paper presented at the Tuberculosis Eradication Conference at Atlanta, Ga., in May, 1921.

The control of bovine infectious abortion, C. P. FITCH (*North Amer. Vet.*, 3 (1922), No. 3, pp. 114-118, 148).—This contribution from the Minnesota Experiment Station consists of a general discussion of the best methods of dealing with the problem of bovine infectious abortion. As methods of control the author recommends: "(1) A general campaign of education as to the nature of the disease and how it is spread. This information should be as uniform as possible throughout the country. (2) Federal, State, and private means should be earnestly solicited for further funds to continue the study of many phases of this disease. (3) Regulatory measures should be instituted to control one of the most virulent sources of infection, the recently aborting cow, and to supervise the use of living vaccines."

Fat necrosis in cattle, W. A. HAGAN (*Jour. Amer. Vet. Med. Assoc.*, 59 (1921), No. 6, pp. 682-688, figs. 6).—"Fat necrosis is a not infrequent disease of cattle in certain parts of this country. The lesions are confined to the fat of the abdominal cavity. The mesenteric fat is especially apt to be affected.

The lesions, especially when small and located in regions where lymph nodes occur, may be mistaken for tubercles. No gross pancreatic lesions have been observed in connection with the disease. In the only pancreas examined microscopically in connection with the disease no pathological changes were noted. The condition, per se, is usually of little consequence. Occasionally, however, the condition may prove fatal."

Ictero-hemoglobinuria in cattle, E. RECORDS and L. R. VAWTER (*Jour. Amer. Vet. Med. Assoc.*, 60 (1921), No. 2, pp. 155-164).—Investigations of an obscure disease of cattle in western Nevada, in continuation of those previously noted (E. S. R., 38, p. 487) and also studied by Meyer in California (E. S. R., 34, p. 782), are here reported upon.

This disease was at first confused with anthrax and later with hemorrhagic septicemia, but is now apparently proven to be a distinct disease entity. The bacteriological studies have been to a great extent concentrated on liver lesions, supplemented by general cultural work throughout the carcass, during the last two years. *Bacillus botulinus* was recovered in four cases from the liver infarcts, and other organisms were associated with it. *B. oedematiens* was recovered from the liver infarct in one case, associated with other organisms, and *B. histolyticus* was also encountered, as have some other not definitely classified anaerobes.

"Colon organisms of the coli-aerogenes and *B. communis* types are frequently found as secondary invaders. A Gram-positive diplococcus apparently belonging to the type IV pneumococcus group is encountered in every case. *B. sporogenes* has been isolated from the liver infarct in a majority of cases. *B. welchii*, type IV, has been found in every case where the cultural methods used and the conditions under which the work was done were such as to make the recovery of this organism possible. It can be recovered not only from the liver infarct but from the portal, mesenteric, and mediastinal lymph glands, spleen, and heart muscle. In no naturally occurring cases, however, have we been able to recover this organism from the blood stream, the tendency being apparently for localization, particularly in the organs mentioned.

"This is the only organism recovered which has shown the presence of hemolytic properties, a fact which, taken together with its uniform presence, has led us recently to concentrate our attention upon it as the possible bacteriological cause of this disease." The findings so far made in connection with *B. welchii* seem to indicate quite strongly that this organism may prove to be responsible for the clinical symptoms and lesions seen in these cases.

Experimental treatment of cattle to prevent ox-warble infestation, M. IMES and F. L. SCHNEIDER (*Jour. Amer. Vet. Med. Assoc.*, 59 (1921), No. 6, pp. 722-727).—This is a report of experiments conducted by the U. S. D. A. Bureau of Animal Industry with *Hypoderma lineatum* and *H. bovis*.

In a comparison made of a number of preparations, the 2 per cent solution of coal-tar creosote dip was the most effective in preventing infestation. The results of the wading tank method of treatment as practiced on two cows indicate that it may prove of great practical value. "The experimental data indicate that cattle having their legs protected below the knees and hocks by the application of insecticidal or fly-repellent substances during the fly season have few if any grubs during the following winter. If on further trial the wading tank method of applying treatment proves to be effective in controlling ox-warble infestation, it seems very probable that suitable adaptations can be devised to meet practical requirements in treating range cattle."

The anthelmintic value of distol against hookworms, T. MAREK (*Jour. Amer. Vet. Med. Assoc.*, 59 (1921), No. 3, pp. 306-309).—Experiments by the author show that hookworm disease of cattle can be cured with distol within a

few days. Two doses proportioned to the weight of the animal (3 gm. to 120 kg. weight and for every further 50 kg. 1.5 gm. more) will probably be sufficient, but to insure satisfactory results it is advisable to give from 3 to 4 single doses without a purgative. The distol is thought to kill the hookworms through being ingested in the blood, since other nonsucking parasites, as bots in the stomach of horses, *Strongylus rubidus* in the stomach of pigs, and ascarids are not affected by distol at all.

Statistical observations on the abundance of nematode parasites in the sheep of Pennsylvania, H. CRAWLEY (*Jour. Amer. Vet. Med. Assoc.*, 59 (1921), No. 6, pp. 728-730).—In examinations made of material from 135 flocks of sheep in Pennsylvania the percentage of those in which the eggs of parasites were found were as follows: *Oesophagostomum columbianum* 64, *Bunostomum trigonocephalum* and *Chabertia ovina* 53, *Haemonchus contortus* 41, *Ostertagia circumcincta* 40, "A" eggs 13, "C" eggs 12, *Capillara* sp. 12, *Gongylonema scutatum* 10, *Trichuris ovis* 7, and *Moniezia* sp. 12 per cent.

Studies on the sheep stomach worm, *Haemonchus contortus* Rud., J. E. GUBERLET (*Jour. Amer. Vet. Med. Assoc.*, 59 (1921), No. 6, pp. 716-721).—This is a summary of information on the life history and habits and methods of treatment for *H. contortus*, based upon a review of the literature and studies conducted at the Oklahoma Experiment Station.

Piroplasmosis of the reindeer, F. CHAMBERS (*Vet. Jour.*, 77 (1921), No. 557, pp. 415-419).—This is a summary of information on an affection of the reindeer in the Tundra of North Russia. It includes a translation of a paper on the subject by S. Kertzelli, in which he describes the causative organism as *Piroplasma tarandi rhangferis*. Smears from two animals were found to contain a pure infection of an organism which resembles *Anaplasma marginale*. A parasite very closely resembling *P. mutans* was observed, but the infections were never pure. The intermediate host of the parasite has not been determined.

The prevention of intestinal worms in pigs, B. H. RANSOM (*Jour. Amer. Vet. Med. Assoc.*, 59 (1921), No. 6, pp. 711-715).

Equine infectious abortion, R. A. KELSER (*Jour. Amer. Vet. Med. Assoc.*, 59 (1921), No. 3, pp. 284-293).—This report is based upon investigations conducted during the course of rather extensive and practically simultaneous outbreaks of equine infectious abortion during the winter of 1919-20 at three army remount depots, namely, Fort Keogh, Mont., Fort Reno, Okla., and Front Royal, Va. There is said to have been no record of an interchange of animals between these depots at any time immediately previous to the outbreaks.

The results confirm the investigations of other workers and show a specific organism of the paratyphoid group to be the cause of the disease. The work has shown that the complement-fixation and agglutination tests, while highly valuable in establishing the presence of the infection in a stud, are unreliable in diagnosing the infection in individual animals. It was found that properly prepared bacterins are highly efficient agents in preventing abortions due to *Bacillus abortus equi*.

Notes on contagious abortion in pony and donkey mares, R. BRANFORD and T. M. DOYLE (*Agr. Research Inst. Pusa Bul.* 121 (1921), pp. 12).—This account is based upon data presented in tabular form on the occurrence of the disease in pony and donkey mares from 1910 to 1920.

Treatments for removing the gastrointestinal parasites of horses, M. C. HALL (*North Amer. Vet.*, 2 (1921), No. 11, pp. 512-524, 550).—This consists of a review of the literature and a report of tests made of carbon tetrachlorid and mixtures of carbon tetrachlorid and carbon bisulphid.

The results indicate that carbon bisulphid in a dose of 6 dr. to a horse properly fasted is a dependable treatment for the removal of bots and ascarids, but

that it is not valuable for the removal of worms in the large intestines. Oil of chenopodium in a dose of 4 to 5 dr., followed by a quart of linseed oil or an aloes ball, to an animal properly fasted is a dependable treatment for the removal of the large strongyles, cylicostomes, and pinworms. It is not, however, of value for removing bots and has but limited value in the removal of ascarids from the horse.

Carbon tetrachlorid is apparently more effective, relatively, against *Gastrophilus nasalis* than against *G. intestinalis*, but its efficacy against bots is less than that of carbon bisulphid, and the latter drug is indicated for the removal of these parasites. Carbon tetrachlorid was ineffective in removing the *Habronema* from one horse, and as this drug is less toxic than carbon bisulphid it is probable that the latter drug should be used rather than carbon tetrachlorid in the case of these worms. It is probable that these worms are immune to attack by the anthelmintics now in use as long as the worms remain burrowed in the mucosa. "Carbon tetrachlorid is apparently as effective as carbon bisulphid in removing ascarids, but the evidence is too scanty to make any positive statements on this point. Carbon tetrachlorid is as effective in doses of 25 to 50 cc. for the removal of the large, blood-sucking strongyles as is oil of chenopodium, but is distinctly less effective in removing cylicostomes. . . . Carbon tetrachlorid is apparently ineffective against pinworms in the horse. The combination of carbon bisulphid and carbon tetrachlorid does not appear to be a particularly valuable one."

A list of 19 references to the literature on the subject is included.

A case of purpura hemorrhagica with special reference to the use of epinephrin, S. D. BRIMHALL and J. G. HARDENBERGH (*Jour. Amer. Vet. Med. Assoc.*, 59 (1921), No. 6, pp. 762-766).—A severe case of purpura hemorrhagica of a horse treated by administration of epinephrin resulted in a fairly rapid and very satisfactory recovery.

Strongylidosis in the horse, C. H. COVAULT (*Jour. Amer. Vet. Med. Assoc.*, 60 (1921), No. 1, pp. 67-75).—This is a paper presented at the annual meeting of the American Veterinary Medical Association at Columbus, Ohio, in August, 1920.

Carbon tetrachlorid for hookworms in dogs, M. C. HALL (*Jour. Amer. Vet. Med. Assoc.*, 59 (1921), No. 3, pp. 310-312).—A more extended account has been noted from another source (*E. S. R.*, 45, p. 286).

Cuterebra larvae from cats, with a list of those recorded from other hosts, M. C. HALL (*Jour. Amer. Vet. Med. Assoc.*, 59 (1921), No. 4, pp. 480-484).

An annotated list of the animal parasites of foxes, W. A. RILEY (*Parasitology*, 13 (1921), No. 1, pp. 86-96).—This contribution from the Minnesota Experiment Station includes a bibliography of 34 titles.

Black locust poisoning of chickens, M. F. BARNES (*Jour. Amer. Vet. Med. Assoc.*, 59 (1921), No. 3, pp. 370-372).—The author records the poisoning, at West Chester, Pa., of fowls of slightly more than one year of age through the eating of leaves of *Robinia pseudacacia*. Affected chickens lie down apparently paralyzed, eyes closed or half closed, comb quite red, and the feces thin, slimy, greenish, and containing strings of mucus or mucus and blood. Such chickens breathed very deeply and heavily and with a thumping motion. Locust leaves fed to chickens at the laboratory resulted in the appearance of symptoms of the affection, followed by death in from 12 to 24 hours. It is thought that the period during which the leaves are toxic for chickens in that section of the country may extend only from July 1 to the middle of August.

Tuberculosis of poultry, C. H. WERKMAN and W. M. GIBBS (*Idaho Sta. Bul.* 126 (1921), pp. 12, figs. 6).—This publication deals with tuberculosis of poultry under the headings of economic importance, cause, symptoms, post-mortem

appearance, transmission, use of the tuberculin test, prevention, and disinfection of a poultry house.

The prevention of the disease is considered best brought about by the exclusion of infected birds from healthy flocks through the application of the tuberculin test and slaughter of all reactors. Results of tuberculin tests conducted at the station indicate that the prevalence and extent of the disease in an infected flock is proportional to the age of the birds, the young birds being only slightly susceptible.

Studies on the use of anthelmintics in fowls, A. B. WICKWARE (*Jour. Amer. Vet. Med. Assoc.*, 59 (1921), No. 6, pp. 731-740).—Experiments by the animal pathologist at the Dominion Experimental Farms at Ottawa, Canada, have led to the following conclusions:

"Pomegranate root bark can not be relied upon as an effective taenicide in fowls. Areca nut, making allowance for degrees of infestation, can not be considered as absolutely reliable, because, although experiments 12 and 13 would indicate a beneficial action, experiments 14 and 15 clearly discount the result. Thymol is apparently inefficient as a taenicide even when administered in larger doses than usually recommended. Fluid extract of male fern, given in exceedingly large doses, failed to have any effect on the tapeworms present in the intestines."

The incidence of blackhead and occurrence of *Heterakis papillosa* in a flock of artificially reared turkeys, H. W. GRAYBILL (*Jour. Expt. Med.*, 33 (1921), No. 5, pp. 667-673).—This is a report of investigations made in a flock, reared in the incubator and brooder and on new soil, which was reduced in number during the summer and fall by death and in other ways from 85 to 42 birds. Five cases of blackhead appeared in this flock during the months of July, September, and October, in four of which *Heterakis* was searched for and found. Of 38 birds from this flock that were killed for food during November and December, 5 harbored no *Heterakis*, and the rest carried light infestations.

"Of 16 healthy birds withdrawn from the above flock during July and placed with a flock of older birds which had passed through this disease in former seasons, all contracted blackhead and 14 died of the disease. The infestation with *Heterakis* was, as a rule, high, reaching 100 specimens in some cases. In general, it appears that a high infestation with *Heterakis* is correlated with a high incidence of blackhead, a relation that had already been inferred in feeding experiments. In both of these groups no other species of worm was found in the ceca, and in instances in which examinations for coccidia were made none was found."

Pheasants which visited the paddock were incriminated as a source of infestation with *H. papillosa* in artificially reared flocks, the parasite having been found in the ceca. The experiments and observations fail to throw any light on the source of the protozoan parasite *Amoeba meleagridis*, which causes the fatal lesions of blackhead.

RURAL ENGINEERING.

Water resources—present and future uses, F. H. NEWELL (*New Haven: Yale Univ. Press*, 1920, pp. 310, pls. 37, figs. 5).—This book constitutes a revision of the addresses delivered by the author in 1913 before the Sheffield Scientific School of Yale University. Its purpose is to present the field of the conservation and use of water, with special emphasis on the economic phases of the subject, in an effort to further the development and utilization of the natural hydraulic resources of the country. It contains chapters on water in general;

precipitation; evaporation; run-in; run-off; storage of water; dams; notable works; use of water; food production, the second use of water; reclamation investigations; irrigation structure and methods; operation and maintenance; transportation of waste, the third use of water; industry and transportation, fourth and fifth uses of water; river regulation; and legal and legislative problems.

Daily river stages at river gauge stations on the principal rivers of the United States, A. J. HENRY (*U. S. Dept. Agr., Weather Bur., Daily River Stages*, 16 (1918), pp. 288; 17 (1919), pp. 291).—These two volumes contain the daily river stages on the principal rivers of the United States for 1918 and 1919, and constitute the sixteenth and seventeenth of the series (*E. S. R.*, 40, p. 209).

Instructions for the installation and maintenance of Marvin water-stage registers, with specifications, R. N. COVERT (*U. S. Dept. Agr., Weather Bur., Instrument Div. Circ. J* (1921), pp. 24, pls. 5, figs. 6).—These instructions include a description of the details of these registers, which are used in stream gauging.

Physical properties of materials.—I, Strengths and related properties of metals and certain other engineering materials, compiled by H. A. ANDERSON (*U. S. Dept. Com., Bur. Standards Circ. 101* (1921), pp. 52).—A compilation of data on the physical properties of different materials used in construction and manufacture is given in this circular. Most of the data was obtained from the results of tests made by Federal and State institutions and technical societies and from technical journals.

Concrete work, W. K. HATT and W. C. VOSS (*New York: John Wiley & Sons, Inc.*, 1921, vol. 2, pp. XIV+206, figs. 37).—This is volume 2 of this work (*E. S. R.*, 44, p. 784). It deals with a number of practical applications of the information and principles outlined in volume 1, and contains sections on drawing and computing; matters preliminary to construction; inspection, proportioning, and tests of materials; forms; mixing concrete; reinforced-concrete construction; sidewalk construction; products; walls; etc.

Red lead and how to use it in paint, A. H. SABIN (*New York: John Wiley & Sons, Inc.*, 1920, 3. ed., rev. and enl., pp. XI+139, pls. 3, figs. 53).—Semitechnical information is given in this book on the physical and chemical properties of red lead and on its technical and practical use in the preparation of paints for different purposes. Methods for analysis of red lead and specifications for painting bridges are appended.

Whitewash and cold water paint, compiled by T. B. SHERTZER (*Natl. Lime Assoc. [Construct.] Bul. 304* (1920), pp. 8).—Popular information on the preparation and use of whitewash and cold water paints is given.

Viscosity and friction, W. H. HERSCHEL (*Jour. Soc. Automotive Engin.*, 10 (1922), No. 1, pp. 31-41, figs. 2).—The author divides the study of lubrication into the various régimes in which different properties of the lubricant have the controlling influence, and discusses at length viscosity effect in the complete film lubrication régime.

Comment is made on the properties of lubricants, units for viscosity measurement, and absolute viscosity relation to the readings of instruments ordinarily used. Mathematical analyses are presented with reference to data given in tabular and chart form. The estimation of viscosity at one temperature from the observed viscosity at another temperature is treated in a somewhat similar manner, including a discussion on complete film lubrication, journal friction, and viscosity.

Consideration is given to the transition point, the relation between the different factors at the transition point and incomplete film lubrication, and the oiliness of lubricating oils. A lengthy discussion is also given of the differences in oiliness of different lubricants as indicated by laboratory and service tests.

Ten specific desirable features of oil friction testing machines are enumerated as (1) means for attaining as high a pressure as possible without danger of an inconveniently rapid change in area of rubbing surface due to wear, (2) a drive arrangement to permit of a sufficiently low speed, (3) a sensitive and easily calibrated method of measuring friction, (4) means for supplying the lubricant in unlimited or in definitely measured quantities, together with a device for spreading it uniformly over the rubbing surfaces, (5) means for measuring the pressure in the oil film, (6) means for measuring the temperature of the oil film, (7) means for controlling the temperature of the bearing, (8) means for observing the point of seizure accurately and to prevent roughening of bearing and journal when seizure occurs, (9) means for measuring and adjusting the film thickness, and (10) means for changing the rubbing surfaces readily to permit the study of wear, bearing metals, and efficiency of oil grooves, and more especially for maintaining the rubbing surfaces at a constant smoothness when testing lubricants.

It is concluded that "in comparing viscosity and friction it is necessary to use a unit of absolute viscosity, preferably the poise or centimeter-gram-second unit. The viscosity in poises can be calculated from times of flow in seconds by suitable equations that are given for the viscosimeters most frequently used. In estimating the change of viscosity with the temperature, it is convenient to make use of the observed fact that, with certain restrictions, the logarithmic viscosity-temperature graphs are straight lines which meet at a point. Friction tests with complete film lubrication can give no information in regard to the quality of a lubricant, and viscosity is measured more readily with a viscosimeter.

"The only use of a friction-testing machine for determining quality of a lubricant is in measuring oiliness, and this must be done at high pressure, low speeds, or other conditions which cause incomplete film lubrication. It can be assumed that the pressure must be over 800 lbs. per square inch (56.2 kg. per square centimeter) or the speed less than 40 ft. per minute (0.2 meters per second). Bearing metals also should be tested with incomplete film lubrication. It is impracticable to keep a constant smoothness of rubbing surfaces with a journal bearing, so that changes in friction, commonly supposed to be due to changes in quality of lubricant, are generally due to changes in smoothness.

"Service tests are even more untrustworthy than friction tests, because there are a multitude of bearings whose temperature can not be controlled or estimated readily. The best solution of the difficulty appears to be the use of a disk machine. The disk could be kept of constant smoothness by removing an interchangeable veneer and subjecting it to a standardized polishing process after the test of each oil, if necessary. A journal could not be kept polished in this way because the radius of curvature, and consequently the film thickness, would be changed."

Pneumatic elevators in theory and practice, W. CRAMP (*Jour. Roy. Soc. Arts*, 69 (1921), No. 3566, pp. 283-294, figs. 14; *abs. in Sci. Abs., Sect. B—Elect. Engin.*, 24 (1921), No. 284, pp. 383-385).—In a preliminary analysis of the subject, it is pointed out that a pneumatic transport plant may be of the suction or pressure type, or a combination of both. The size and weight of the particles of materials to be moved are liable to vary so much as to render even an approximate calculation of the air pressure very unreliable. In the case of grain and similar regularly granular materials, however, much more accurate prediction of pressures is possible. Most existing plants are of the suction type. The experimental work reported deals with the nozzle which dips into the grain, the pipes conveying grain and air, and the exhauster as being the more important essential parts of a suction plant.

A study of general principles indicated that the grain is never so closely packed but that air can be drawn through the interstices even when the nozzle is buried to a depth of several feet. The air exerts a force upon the grain tending to cause it to follow the air. The grain accelerates until the force produced by the air is balanced by such retarding forces as the weight of the grain and its friction against the sides of the pipe.

Studies of the pressure exerted by the air on the grain in vertical pipes showed that the motion of the air is always turbulent. The author was led to suppose that the force acting on the grain can be expressed by the formula $W=a(V_a-V_g)^2$, in which W is the force, V_a is the velocity of the air, V_g is the velocity of the grain, and a is a factor dependent upon the density of the air and the shape of the grain. The factor a was established for different materials by first determining the number of grains which would "float" in a glass tube at various air velocities, and substituting the average flotation velocity in the above formula in which the velocity of the grain would be equal to zero. Values of a of 0.00052, 0.00345, 0.0004, 0.00086, 0.00021, 0.00003, and 0.0002 were established for northern Manitoba wheat, maize, Karachi wheat, malt, broken wheat, wheat husks, and cockle, respectively. Curves are given showing the relation of grain velocity to the height lifted in the tube.

In experimental measurements of grain velocity to see if the equation corresponds with actual facts, grain was drawn up a vertical pipe about 9 meters (29.5 ft.) long and 6.45 cm. (2.5 in.) in diameter, and attempts were made to measure V_g over a given length of pipe. It was found that the calculated mean value of the grain velocity is usually greater than the experimental value which makes due correction for friction. The velocity of the grain was found to increase from 1.5 to 10 meters per second as the air velocity increased from 10 to 20 meters per second.

A study of the relation between grain velocity and air pressure showed that the pressure difference for wheat is equal to

$$207 \frac{L}{F} \left\{ \frac{V_f}{9.81} + \frac{S}{0.8} \left(\frac{1}{V_f} + \frac{0.018}{L^{\frac{1}{2}}} V_f \right) \right\} + 0.0011 V_a^2 \frac{S}{d} + 0.00092 V_a^2$$

in which V_f is the velocity attained by the grain at the top of the pipe, as given by the expression

$$V_f = \frac{V_a \sqrt{\frac{0.97}{L^{\frac{1}{2}}} (V_a^2 - 54)} + 54}{1 - \frac{0.97}{L^{\frac{1}{2}}}}$$

L is the grain lifted in tons per hour, F is the area of the pipe in square centimeters, V_a is the velocity of the air at the top of the pipe in meters per second, S is the length of the pipe in meters, and d is the diameter of the pipe in centimeters. A table comparing the calculated and experimental results is given, indicating that the above formula may be expected to hold good for pipes not shorter than 9 meters, with air velocities not exceeding 40 meters per second and a vacuum not exceeding 25 cm. of mercury.

Studies of the conditions which limit the efficiency of a vertical conveyor, in which four types of acceleration were considered, showed that long pipes are more efficient than short ones, though not in proportion to length; that a plant will work more efficiently with light and bulky material than with heavy and compact material; and that the increase in efficiency obtained by the kinetic energy of the grain is small. A comparison of these theoretical deductions with actual results achieved in practice indicates that at low velocities the agreement between theory and practice is specially good. so that

the efficiency achieved is of the order of 20 per cent and in certain cases exceeds this figure. It is concluded that by proper design efficiencies can be reached in practice which approximate the maximum possible. Tests of nozzles showed that for each type of nozzle the ratio $\eta = \frac{L}{F_o V_{ao}}$ is approximately constant, and that it has an extremely important bearing on the design and performance of the plant. In this expression F_o is the area of the nozzle in square centimeters and V_{ao} is the velocity of the air at the nozzle calculated on F_o . Also the following expression was found to be nearly correct:

$$\frac{L}{F} = \eta \left(1 - \frac{P_o - P}{P_o} \right) V_a$$

In this expression $P_o - P$ is the difference in pressure or pressure head.

It is concluded that this expression may be taken with those given above as a basis for the design of new plants. "From these the corresponding horsepower per ton per hour can also be derived, and this is a satisfactory method for designing a plant with an appropriate nozzle . . . The tests show the inefficiency and uselessness in many cases of the auxiliary air inlet which is a feature of all existing commercial plants; and they further show that up to a load density of 0.35 tons per hour per square centimeter of pipe area, which is a far higher load than that met with in practice, no choking nor instability of any kind was experienced."

The architects' and builders' handbook, F. E. KIDDER and T. NOLAN (*New York: John Wiley & Sons, Inc., 1921, 17. ed., enl., pp. XXIV+1907, figs. 978*).—This is the seventeenth edition of this handbook, which contains data for architects, structural engineers, and contractors. Part 1 deals with practical arithmetic, geometry, and trigonometry. Part 2 covers strength of materials and stability of structures. Part 3 gives useful general information for architects, builders, and superintendents.

Heat loss through various types of building construction, L. A. SCIPIO (*Jour. Amer. Soc. Heating and Ventilating Engin.*, 27 (1921), No. 6, pp. 637-643, figs. 2).—Studies on the relative heat losses through the walls of five specially constructed small houses, with different types of wall construction, but with identical floors and roofs are reported.

Each house is an 8.5 ft. cube to the ceiling, and each has a floor made of concrete 6 in. thick set directly on the ground. The roofs are made of 2 by 4-in. timbers double sheathed with wood and overlaid with composition roofing which is air and rain tight. The ceiling is of plaster board and the regular coatings of plaster.

House No. 1 consists of a framework of 2 by 4-in. wood studding sheathed on both sides by ½-in. plain gypsum plaster board and one thickness of building paper, stuccoed with cement plaster on the outside, and faced with wood fiber plaster on the plaster board on the inside. Pieces of board 4 in. wide are placed horizontally between the studding at a height of 3.5 ft. above the floor level to shorten the free air columns contained therein. House No. 2 has a double wall of pressed dry mixed concrete blocks so shaped as to have a partial integral bond of concrete formed by interlocking lugs. The wall has an uninterrupted air space from floor to ceiling, and contains 1.048 cu. in. of concrete per square foot of wall surface. House No. 3 has a double monolith wall, each part of which is 4 in. thick and with a 4-in. free air space between. The mass of concrete is 1,260 cu. in. per square foot of wall surface. The object of this arrangement was to show the influence of uninterrupted convection currents within the wall. House No. 4 has a double wall of hollowed-

out concrete blocks, pressed with the hollow sides facing each other and having a minimum space of about $\frac{3}{4}$ in. between opposing rims arranged to partly retard convection at every course. Convection is completely interrupted at a point one-half way of the height of the wall by a layer of tar paper across the joint. House No. 5 has a double monolith concrete wall with the same dimensions and arrangement as in No. 3, except that the air space is filled with oiled wood shavings.

The buildings were heated by means of electric stoves and a constant amount of heat energy of 40 kw. hours per day was furnished to each house. The most striking feature of the results was the difference in cost per month of heating the houses Nos. 3 and 5. The value of completely breaking up the possibility of convection currents is shown by the fact that 43 per cent more heat was required to maintain a temperature of 70° F. in No. 3 than in No. 5. While there is more than 50 per cent more material in No. 2 than in No. 4, the difference in heat saving was only about 8 per cent. With the exception of No. 5, house No. 1 showed the best economy, although it is the cheapest type of construction.

Emissivity of heat from various surfaces, V. S. DAY (*Ill. Univ., Engin. Expt. Sta. Bul. 117* (1920), pp. 39, figs. 11).—Tests of heat insulating materials and surfaces, conducted as a part of the warm-air furnace investigation in progress at the University of Illinois, are reported.

The apparatus used consisted of five low-pressure steam-heated drums surrounding a central steam header. The drums were accurately uniform in size, 10 in. in diameter by 20 in. long, and were made of sheet metal of the kind to be tested. One drum of bright tin not insulated was used in all tests as a check. Forty tests were conducted with the drums in different positions around the steam header.

The use of thin sheets of asbestos paper on bright tin heat pipes resulted in a waste of heat. Uncovered bright tin pipes were more efficient carriers of heated air than asbestos paper-covered bright tin pipes, regardless of the degree of brightness of the tin surface. Several thicknesses of asbestos were necessary to make a covering equal as an insulator to the bare tin. The heat loss from warm-air furnace pipes covered with one layer of asbestos paper was found to amount to more than 5 per cent of the coal consumption, depending upon the number and size of pipes used. The loss was not greatly affected by protection of the pipes from convection air currents by joists and studding. Accumulations of dust and dirt on the pipes did not greatly alter the amount of heat loss.

It is concluded that unless the insulation used excels the uncovered bright tin in heat insulating properties it should not be used.

Chimneys for house heating boilers, L. A. SCIPIO (*Jour. Amer. Soc. Heating and Ventilating Engin.*, 27 (1921), No. 4, pp. 463-468).—In a contribution from the Institute of Thermal Research, data from different sources and from the results of original studies on the design of chimneys for residential heating plants are summarized. These include several formulas for computing the sectional areas of chimneys.

Records of 43 different tests are reported, in which the load on the boiler is reduced to square feet of radiation, assuming that 1 lb. of steam formed would be condensed by 4 sq. ft. of radiation in an hour. From the results of experience the Institute has developed the formula $R=3.2 eVH$, in which R is the square feet of radiation carried, H is the height of the chimney in feet, and e is the effective area of the chimney in square inches remaining after subtracting the area of a strip 2 in. wide next to the inside wall from the whole.

Poultry houses, W. F. SCHOPPE (*Montana Sta. Circ. 100* (1921), pp. 23, figs. 9).—Brief information, drawings, and bills of material for poultry houses which have been found adapted for Montana conditions are presented.

It is the author's opinion that environmental conditions are either directly or indirectly responsible for most of the diseased conditions of poultry. Poultry houses should, therefore, provide for an abundance of sunshine and fresh air.

For Montana conditions a wide house has been found to be preferable to a narrow one, since it places the roosts farther from the openings in the front and the birds are less affected by outside changes in temperature. It is considered advisable to sheathe houses on the inside to give extra protection during extremely cold weather, and to sheathe them overhead in order to cut down the air space. The combination curtain and glass front house has proved very satisfactory in many sections of the State. It provides good ventilation, abundance of sunshine, does not allow a draft to strike directly on the birds, and is to be preferred to the open-front house.

RURAL ECONOMICS AND SOCIOLOGY.

Farm management, R. L. ADAMS (*New York and London: McGraw-Hill Book Co., Inc., 1921, pp. XX+671, figs. 100*).—This textbook is a compilation of illustrative material largely from farm management surveys arranged in 26 chapters covering, respectively, general considerations of farm management; selecting farming as an occupation; selecting the farm business; selecting the farm; organizing the farm business; the soil factor; the calendar of operations; choice of farm equipment; building equipment; fencing, work stock, implements, and machinery; the capital requirements of farming; farm profits; factors affecting profits; financial forecast of proposed farm plans; farm management surveys; farm bookkeeping; farm cost accounting; costs of producing crops; costs of producing live stock and stock products, miscellaneous costs; marketing methods; market quotations; farm labor; farm tenancy; farm lease forms; farm law; and the farm manager. An index to references used throughout is included in chapter 27, forming a partial bibliography of bulletins and papers on farm management.

[Annual report of the Jewish Agricultural and Industrial Aid Society for the year 1921] (*Jewish Agr. and Indus. Aid Soc. Ann. Rpt. 1921, pp. 67*).—This report continues information previously noted (E. S. R., 45, p. 88).

Manual for estimating the value of land in forest and for forest measurement, M. ENDRES (*Lehrbuch der Waldwertrechnung und Forststatik. Berlin: Julius Springer, 1919, pp. XI+324, figs. 7*).—Methods of forest land valuation on the basis of yearly returns are set forth in detail.

The Swedish agricultural laborer (*Stockholm: Swedish Deleg. Internatl. Collab. in Soc. Politics, 1921, pp. 94, pls. 8, figs. 4*).—This report consists of a compilation of information from the occupational census statistics gathered by Swedish Labor Exchange officers and from Labor Board inquiries. The phases of the agricultural labor situation covered include the number and distribution of agricultural laborers; supply of work; the right of association and collective agreements; hours of labor and overtime; wages and standard of living; female and child labor; housing conditions; protection against accident, sickness, infirmity, and old age; technical agricultural education; and migration and the effort to establish small holdings and land settlements. Statistics assembled since 1911, in a few instances including the year 1920, are included.

Market analysis, its principles and methods, P. WHITE (*New York and London: McGraw-Hill Book Co., Inc., 1921, pp. IX+340, figs. [33]*).—The author proposes to give a perspective of scientific market analysis, with instructions

that may serve as a guide to the technique and method of the market survey and for presenting the data on the product to be marketed, the company, its competitors, its customers, the nature and size of the market, and its potentialities and limitations, methods of distribution, sales and advertising, and the foreign markets. Many of these directions might be applied to the marketing of agricultural commodities. A classified bibliography of 35 titles is included.

New railroad freight rates for agricultural products, E. POHER (*Vie Agr. et Rurale*, 20 (1922), No. 4, pp. 62-64).—Schedules of special slow freight rates and rates on certain classes of agricultural products or on large shipments direct to a given destination are submitted, which may be used in calculating freight charges on French railways.

Proposed reforms in the system of food distribution, W. R. CAMP (*Jour. Polit. Econ.*, 29 (1921), Nos. 9, pp. 746-756; 10, pp. 806-827).—Consideration is given to certain reforms proposed by the Federal Trade Commission with regard to the control of the distribution of milk and produce. First of these is that all railroads should be required to unload and receive all perishable food products at central terminals, and that storage plants and wholesale markets should be provided or regulated by the Federal Government. Other proposed reforms are noted and criticized as not affecting the volume of business of the distributors and not in any way making provision for directing shipments so as to prevent over- or under-stocking of markets. It is said further that no constructive provisions have been made for the improvement of distributive systems for marketing and retailing meat products.

It is alleged that the bias of the Federal Trade Commission in favor of free competition has led it to consider the strategic methods of the packers which interfere with competition and to overlook the industrial advantages of the system which the packers have built up. The reforms proposed are said to leave all discretionary power as to distribution in the hands of the owners of surplus products, whereas any effective reform must abolish the conflict of interests between the producers, distributors, and consumers.

Agricultural conditions and the farmers' movement [in Canada], J. C. HOPKINS (*Canad. Ann. Rev. Pub. Affairs*, 20 (1920), pp. 79-137, pl. 1).—These pages continue information along the general plan of an earlier report (E. S. R., 44, p. 387).

[Interim reports from the select committee upon the conditions and prospects of the agricultural industry and methods of improving the same] (N. S. Wales Leg. Council, *Interim Rpts. Select Com. Conditions and Prospects Agr. Industry [etc.]*, [1] (1920), pp. VII+52, pl. 1; 2 (1920), pp. XI+52-114; 3 (1920), pp. XVII+115-144, figs. 3; 4 (1920), pp. XVII+145-151, fig. 1; *Min. Proc.*, pp. XVII+152-259; 5 (1920), pp. XX+1-14, pls. 12).—These reports, together with minutes of evidence and appendixes, embody the testimony of witnesses, including educators and administrators of government bureaus in New South Wales, representatives of marketing organizations, practical farmers, and others, given in 1920 in regard to the needs of agriculture and possibilities of improving agricultural teaching, marketing chiefly of wheat, rural credit, prices, and conditions of living in the rural districts of New South Wales.

Agricultural legislation, 1921 (*Mass. Dept. Agr., Dept. Bul. 42* (1921), pp. 16).—Legislation concerning the powers and duties of the Massachusetts Department of Agriculture, agricultural and rural education, and measures and standards; general agricultural legislation; and that concerning wild birds and game, enacted in Massachusetts in 1921, is printed here.

The Canada Grain Act, 1912, with amendments to date, September 1, 1921 (Ottawa: Dept. Trade and Com., 1921, pp. VII+80+2).—This gives the text of the Canadian Act in respect to grain grading and distribution.

A survey of farm homes, I. M. BAILEY and M. F. SNYDER (*Jour. Home Econ.*, 13 (1921), No. 8, pp. 346-356).—The homes on 91 farms in a selected area in St. Joseph County, Mich., were visited in the spring of 1917. Information was obtained regarding the character and equipment of typical farm homes, household labor, social life, and economic conditions, also those phases of farm work which most directly affect either the food supply of the farm or the work of the farm housekeepers.

The farms ranged in size from 3 to 400 acres, averaging 115, of which an average of 97 acres were under cultivation. There were 72 owners and 19 tenants among the operators of the farms studied. Fifty-two per cent of the families had lived in the community 25 years or more, 8 per cent less than 5 years, and 2 per cent less than 2 years.

This article contributes a brief record of the findings as regards live stock, orchards, gardens, grounds, general character of houses, storage facilities, screens, lights, arrangements for heating and cooking, water supply and sewerage, desire on the part of housekeepers for modern improvements, labor-saving devices used, size and character of families, health, household help, length of working day, time spent on special kinds of work, social and community life, and income and expenditures.

Urban and rural population and dwellings [G. H. KNIBBS] (*Aust. [Bur. Census and Statis.], Census Bul. 2* (1921), pp. 4).—Five preliminary tables are given subject to revision, including statistics from the census of Australia of 1921.

Cooperation among fruit growers in Massachusetts, D. H. HUNTOON (*Mass. Dept. Agr., Dept. Bul. 26* (1921), pp. 38).—This bulletin has been edited by L. P. Jefferson, who also prepared the introduction, noting briefly factors and fundamental principles underlying successful cooperation, defining certain types of organizations, and giving examples of each. Seventeen associations are reported on. In appendixes farmers' cooperative exchanges, cooperative associations handling fruit, strictly fruit growers' organizations, and cooperative organizations which handle no fruit are listed.

The Grange master and the Grange lecturer, J. BUELL (*New York: Harcourt, Brace & Co., 1921, pp. XIII+178*).—This book is intended to indicate the scope of the work of the Grange and how it is fitted for rural leadership. It sets forth the origin and ideals of the organization and describes the province of the Grange master as an administrator and community leader and that of the Grange lecturer in making and conducting programs. Many working suggestions are offered, especially in regard to methods and training in lecture work.

Graphic presentation of statistics of farm products, H. E. SELBY (*Montana Sta. Circ. 99* (1921), pp. 46, pl. 1, figs. 48).—In part 1 of this circular available statistics, showing (1) the average farm price each year and the general trend of the price, (2) the acreage of crops or number of animals on farms in the United States each year and the general trend of same, (3) the yearly average yield of crops and its trend, (4) yearly exports and imports except when of minor importance, and (5) miscellaneous information of interest in a consideration of certain products, for the more important field crops and farm animals since 1890 are presented graphically. Charts given in part 2 show the monthly prices of various farm products for a period of 10 years, 1910 to 1919, inclusive.

Wisconsin agricultural statistics for 1920, annual crop and live-stock review, J. A. BECKER (*Wis. Dept. Agr. Bul. 34* [1921], pp. 124, figs. 31).—These notes and graphs, together with statistical tables, continue annual crop reports noted for the previous year (*E. S. R.*, 45, p. 294).

[**Agricultural statistics for the United Kingdom, 1905-1919**] (*United Kingdom Statis. Abs.*, 66 (1905-1919), pp. 310-323).—Statistical data for two years have been added to the report previously noted (E. S. R., 43, p. 95).

Statistics of cereals and legumes, 1921 (*Estadística de la Producción de Cereales y Leguminosas. Madrid: Junta Consult. Agron., 1921, pp. [40]*).—These statistics of production in Spain for the year 1921 continue reports previously noted (E. S. R., 45, p. 696).

Statistics of agricultural and pastoral production, C. W. COUSINS (*Union So. Africa, Off. Census and Statis., Agr. Census, 1919, pp. [2]+20; 1920, pp. 38*).—Census returns for the fiscal years 1918-19 and 1919-20 in the Union of South Africa are presented, continuing the report previously noted (E. S. R., 44, p. 92).

AGRICULTURAL EDUCATION.

State-aided vocational and part-time education in Massachusetts (*Mass. Dept. Ed. Bul. 3* (1921), pp. 287).—This report is presented in accordance with the organization of the Division of Vocational Education by fields of supervision and teacher training in relation to agriculture, agricultural and industrial teaching, and administration. Financial and vital statistics are included in nine tables.

Ontario's work under the Agricultural Instruction Act, W. B. ROADHOUSE (*Agr. Gaz. Canada, 9* (1922), No. 1, pp. 26-30).—This summarizes briefly expenditures through nine years and outlines the development of the system of agricultural teaching in Ontario, functioning through school fairs, clubs, and farmers' organizations. The growth and teaching program of the Ontario Agricultural College and of the Kemptville Agricultural School are reviewed.

The origin, activities, and possibilities of women's institutes in Ontario, G. A. PUTNAM (*Agr. Gaz. Canada, 9* (1922), No. 1, pp. 30-34).—The history and program of women's institutes in Ontario are outlined, answering questions as to the governing body, teachers, pupils, curricula, textbooks, and methods of teaching.

Agricultural education in Australia, A. J. PERKINS (*So. Aust. Dept. Agr. Bul. 154* (1921), pp. 16).—This is a reprint of an address noted from another source (E. S. R., 45, p. 598).

Biology for beginners, T. J. MOON (*New York: Henry Holt & Co., 1921, pp. X+558, figs. [172]*).—This course in elementary biology emphasizes the fact that biology is a unit science based on the fundamental idea of evolution rather than a combination of portions of botany, zoology, and hygiene. The material is presented in 54 short chapters, each headed by a vocabulary of terms used in the lesson and concluded with a summary and list of collateral readings. A large proportion of the pages is devoted to outlines, tabulations, and diagrams. The economic applications of biology, especially with relation to agricultural, civic, and hygienic problems, are developed in the later chapters. Brief historical notes are given on the development of the science.

Crops and tillage, J. C. NEWSHAM (*London: Methuen & Co., Ltd., 1921, pp. XII+186, figs. 24*).—This volume is intended as a textbook and guide to successful farm practice, setting forth the nature, properties, and manurial requirements of the chief economic plants.

Principles of feeding and calculation of rations, R. W. CLARK (*Fort Collins: Colo. Agr. Col. Ext. Serv., [1920], pp. 19*).—This text shows step by step how to calculate rations, being intended for use in extension courses in animal husbandry for farmers.

Report of the subcommittee on collegiate training of dietitians (*Jour. Home Econ., 14* (1922), No. 2, pp. 70-75).—This was submitted at the annual

meeting of the American Dietetic Association in Chicago, October, 1921, by A. Marlatt, chairman of the committee. A minimum two-year course is recommended to meet the needs of certain smaller hospitals, indicating the need for courses in physics, chemistry, biology, and psychology, with a somewhat longer allotment of time to practice in cookery processes and detailed study of the preparation of food in large quantities than is provided for in the four-year course. It is recommended that the graduate of this shorter course should be assigned for one year as assistant dietitian in a hospital where the head dietitian has had wider training.

The four-year course leading to the bachelor's degree is divided into groups, including general education in arts and science, advanced science, food study, textile study, housing and sanitation, dietetics, institutional administration, and clinical laboratory diagnosis. Courses are suggested under the last group because the dietitian must understand the vocabulary and technique and be able to understand the findings in connection with laboratory diagnosis.

Suggestions are made for a year of graduate study leading to a master of science degree.

Report of subcommittee on teaching dietetics to student nurses (*Jour. Home Econ.*, 14 (1922), No. 2, pp. 75-81).—This committee report was presented at the meeting noted above by K. Fisher, chairman. It consists of a preliminary outline covering time, instructor, preparation of class, laboratory equipment, aims of the course, methods of teaching, content of the course, and practical work in the diet kitchen. In addition, a course in dietotherapy is similarly outlined.

Report of the subcommittee on professional training of dietitians in hospitals and medical schools (*Jour. Home Econ.*, 14 (1922), No. 2, p. 82).—This brief outline was submitted by R. Wheeler, chairman of the committee.

Beginning clothing project, junior agricultural clubs (*Ky. Agr. Col. Ext. Circ.* 112 (1921), pp. 30, figs. 16).—Directions are given for sewing projects and for scoring the work called for.

The new world problems in political geography, I. BOWMAN (*Yonkers-on-Hudson, N. Y.: World Book Co.*, 1921, pp. VII+632, figs. 280).—This text deals with world political problems setting forth in the main both sides of debatable questions. It is profusely illustrated with maps and engravings from photographs. A briefly annotated bibliography (pp. 583-598) is included. In the appendix there has been arranged a list of treaties and agreements, 1814 to 1920, chiefly those mentioned in the text, showing the date, name, signatories, and terms of importance in this book.

A list of books for the farmer's library (*Illinois Sta. Circ.* 251 (1922), pp. 27).—A few books which are considered dependable and readable are noted and described under each of the subject heads of agronomy; soils; animal husbandry; breeding of animals and plants; dairy husbandry; farm mechanics; forestry; home economics; horticulture; insects, birds, and fish; poultry; rural economics and farm management; and rural sociology and country life. Public sources of information along certain lines and the full name and address of publishers referred to are listed.

MISCELLANEOUS.

Forty-fourth Annual Report of Connecticut State Station, E. H. JENKINS ET AL. (*Connecticut State Sta. Rpt.* 1920, pp. XVI+377, pls. 19, figs. 119).—This report contains respectively, the organization list, a report of the board of control, a financial statement for the fiscal year ended June 30, 1920, and reprints of Bulletins 223-231.

Annual report of the director for the fiscal year ending June 30, 1921, C. A. MCCUE ET AL. (*Delaware Sta. Bul. 129 (1921)*, pp. 30).—This contains the organization list, a report of the director, including a financial statement for the fiscal year ended June 30, 1921, and departmental reports. The experimental work recorded is for the most part abstracted elsewhere in this issue.

Report of Hawaii Station, 1920, J. M. WESTGATE ET AL. (*Hawaii Sta. Rpt. 1920*, pp. 72, pls. 10, figs. 2).—This contains the organization list, a summary by the agronomist in charge as to the work of the year, and reports of the divisions of horticulture, agronomy, chemistry, plant pathology, and extension, and of the Haiku Substation and the extension agent on the island of Hawaii. The experimental work recorded is for the most part abstracted elsewhere in this issue.

Thirty-ninth Annual Report of New York State Station, 1920, W. H. JORDAN ET AL. (*New York State Sta. Rpt. 1920*, pp. VII+586, pls. 21, figs. 37).—This report contains the organization list; a financial statement for the fiscal year ended June 30, 1920; a list of the periodicals received by the station; meteorological observations abstracted on page 618 of this issue; and reprints of Bulletins 471-479 and 483; Technical Bulletins 75-80 and popular editions of Bulletins 472-474, 476, 477, and 479.

[Biennial Report of the Oregon Station, 1915-1916], A. B. CORDLEY (*Oreg. Agr. Col. Bul. 250 (1917)*, pp. 63-68, 142-147).—These pages briefly record the work of the station during the biennium ended June 30, 1916, with a financial statement for the period.

[Biennial Report of the Oregon Station, 1917-1918], A. B. CORDLEY (*Oreg. Agr. Col. Bul. 297 (1919)*, pp. 4-29, 113-119).—These pages include a report by the director on the work of the station for the biennium ended June 30, 1918, with a financial statement for the period. The experimental work reported is for the most part abstracted elsewhere in this issue.

Publications available for free distribution (*Idaho Sta. Circ. 20 (1921)*, pp. 2).—The bulletins and circulars available for distribution are listed.

NOTES.

Arizona University and Station.—J. J. Thornber, director of the station, has also been appointed dean of the college of agriculture, beginning July 1. The enrollment in the college has increased during the past two years from 37 to 141.

California University and Station.—Construction of the new botanical building on the university farm at Davis will soon be begun. A two-story building is contemplated, housing instruction and investigation work of the divisions of botany, pomology, and viticulture. The first floor will be devoted to classrooms and teaching laboratories with a large auditorium, and the second floor to offices and experimental laboratories.

The cereal nurseries at Chico of the Bureau of Plant Industry, U. S. Department of Agriculture, have been transferred to Davis and combined with the cereal experimental work of the university under a cooperative agreement. Duplicate collections are also being grown at Moro, Oreg., and Aberdeen, Idaho, in cooperation with the stations in these States.

John W. Gregg, head of the division of landscape gardening and floriculture, has been granted a year's sabbatical leave, which will be spent in travel through Europe for the purpose of studying old and new examples of landscape architecture and city and town planning.

Connecticut College.—Henry R. Monteith, professor of English and history for 22 years, died March 21 at the age of 74 years.

Illinois University.—H. W. Mumford, who has been for two years on leave of absence as director of the live stock marketing department of the Illinois Agricultural Association, has returned as head of the animal husbandry department. Dr. G. N. Coffey, State leader of extension work, has resigned to engage in commercial work.

Massachusetts Station.—Webster S. Krout, assistant research professor in the department of botany, has been transferred from the main station to the Market Garden Field Station at East Lexington, to have charge of pathological work on fruit and vegetables. This change in the organization is being financed in part by appropriations made by the Boston Market Gardeners' Association and the Nashoba Fruit Producers' Association.

The cranberry growers of Cape Cod have voted a voluntary assessment to provide additional studies at the Cranberry Substation.

Michigan College and Station.—John H. Harman has been appointed extension specialist in entomology, beginning May 10. C. W. Bennett has been transferred from the instruction to the station staff as research assistant in plant pathology, effective July 1. P. S. Lucas has been appointed associate professor of dairy manufacturing and C. F. Huffman research assistant in dairying, both appointments becoming effective July 1.

Minnesota University and Station.—The resignations are noted of L. J. Cook, clinical assistant in the division of veterinary medicine; Herbert R. Pettigrove, instructor in agronomy and farm management; and Ella Person, statistician in the division of agronomy and farm management. Ralph C. Crim has been appointed extension specialist in agronomy, Clarence E. Mickel assistant in economic entomology, Reuben M. Pinckney research assistant in

soils, Paul M. Gilmer assistant in entomology and economic zoology, Benjamin Forbell field assistant in soils, and Kenneth F. Warner live stock specialist in agricultural extension.

Nebraska Station.—Rudolph Sandstedt has been appointed station analyst in the department of agricultural chemistry.

Cornell University.—The legislature has appropriated \$15,000 to equip a cold storage plant in the pomology orchards, and \$183,000 for equipping the new dairy building.

New York State Station.—In a special act passed by the legislature during its recent session, funds have been provided for establishing field experimental work on Long Island under the joint direction of the station and the New York State College of Agriculture, for the study of soil fertility problems relating to truck crops and of means of controlling insect and disease pests affecting them. The act carries an appropriation of \$45,840 to provide for the purchase of a tract of land and the erection of a greenhouse, the purchase of equipment, and the employment of an entomologist and a plant pathologist to be permanently located at the station. The general administration of the station and the soil and cultural experiments will be under the direction of the College of Agriculture, while the work on plant pests, including the appointment of the entomologist and plant pathologist, will be under the direction of the State station. Plans are under way for carrying out the provisions of the new law, and it is expected that the experiments will be in operation in the near future.

A new station position was also created by the legislature under the title of associate in research (vegetable gardening and canning crops) to which on April 1 Frank H. Hall, formerly editor and librarian and more recently assistant in research (horticulture), was appointed. A new line of work has been inaugurated which has for its object a comprehensive study of all varieties of vegetables hardy to New York conditions, with the view of improving existing varieties by breeding and selection. Muskmelons and peas are to be studied this season.

Leon R. Streeter, assistant chemist, has been assigned to the study of the chemistry of certain insecticides under the direction of Director Thatcher. This study has been made possible by a special appropriation by the legislature.

Recent appointments to the staff include George L. Slate as assistant in research (horticulture) and Harold G. Beattie as assistant chemist.

North Dakota Station.—Charles H. Ruzicka, superintendent of the college farm, resigned May 1 to become county agent of La Moure County.

Pennsylvania College and Station.—P. R. Smith resigned March 15 as assistant in plant pathology extension. W. H. Davis, assistant in dairy husbandry extension, has been appointed county agent in Erie County. New appointments include D. L. Van Dine as assistant professor in entomology extension, M. J. Armes as assistant in experimental agronomy, and Charles E. Fox as assistant in cooperation and rural organization extension. Several changes in academic titles have also been made, including S. I. Bechdel from professor of dairy husbandry to professor of dairy production, A. L. Beam from associate professor of dairy husbandry to associate professor of dairy production, A. W. Cowell from professor of landscape art to professor of landscape architecture, and W. H. Martin from instructor in dairy husbandry to instructor in dairy manufacturing.

Wisconsin University.—A beef cattle barn, 160 by 40 feet and to cost approximately \$16,000, is under construction.

EXPERIMENT STATION RECORD.

VOL. 46.

JUNE, 1922.

No. 8.

It is sometimes profitable to pause, take account of stock, and consider in the light of changing conditions what is the best thing to do or the wisest course in planning for the future. This is notably the case in such a field as agriculture, where there have been such significant and far-reaching changes, both local and national; and for the institutions which stand for instruction and research in that industry and have come to wield so powerful an influence, such a course is especially important.

Events have followed one another so fast at these institutions in the past quarter century that there has been relatively little of this or attempt at a long-range vision. Recognition of their work once started, it has been largely a case of keeping up with the trend and attempting to meet the public demand, not without constructive effort, but with the near future especially in mind. There have been building programs, of course, and those for the provision of land and other facilities, which have often come too late; but the broad study of conditions and tendencies in agriculture in the attempt to see into the future far enough to make a comprehensive working program has been rarely undertaken.

A program is a useful thing even if it is not closely followed. It has the advantage over the plan of taking things as they come and trying to adjust to it—or following rather than to lead. A studied program is something to guide thinking and around which to plan. It can rarely be complete or inflexible, but it avoids fortuitous, tentative action, or recognizes it as purely such. Lately a number of agricultural colleges have begun to give attention to such studies as a means of defining and shaping policy, and it has been urged at the meetings of their national body.

The recent attempt of one institution to provide a basis for an agricultural program and develop a policy in relation to agriculture is of wide interest because of its comprehensive character, the food for thought it supplied, and the fact that a follow-up was arranged for. In the latter part of January a broadly representative conference on Illinois agricultural policy was held at the College of Agriculture to consider as far as time permitted "the general subject

of the future of agriculture in Illinois in the next twenty-five years." This will be recognized as a large and difficult program. It related to the course of the college and its integral parts and to the shaping of the industry. The purpose was quite clearly stated by President Kinley to be "to consider the direction or trend of the development of agriculture in Illinois in the next decade or two, with special consideration of the part that the university college of agriculture and the agriculture experiment station can or may play in that development." The call to the conference included farmers, scientists, and educators in agriculture, and invitation was extended to all interested citizens of the State to take part in it.

The printed account of the conference has just been issued. It constitutes an interesting volume of nearly two hundred pages, comprising thoughtfully prepared papers presented by twenty-three speakers. The five main heads under which these are grouped give an idea of the nature of the proceedings. Following the presentation of several papers on a quarter century of agricultural progress in Illinois—a review of accomplishments, some of the newer phases of agricultural progress were dealt with, and agriculture in its relation to other interests was taken up. This led up to the consideration of next steps in agricultural development, with specific reference to a program for a better balanced agriculture; and, finally, the place of the agricultural college and experiment station in such a program for agricultural development was brought out in a way to crystallize many of the thoughts evolved in the general conference.

The holding of such a conference as this was especially opportune. It followed a vigorous campaign for a financial policy for the university which gave it a substantial foundation. In this the needs of the college of agriculture were fully considered, and it will be one of the first to receive new headquarters building under the special appropriations. It came in the midst of a serious agricultural depression, which, while in a general way resulting from the war, may well be, as President Kinley said, "part of a readjustment not only of temporary conditions but of conditions which in character are more permanent." In his opinion American agriculture probably reached a point within the past decade at which it was to assume a different character from what it had in the past generation; and, finally, it came with the culmination of 25 years' service of Dean Davenport, under whose guidance such remarkable development has taken place and whose retirement at the close of the present session is announced. It was a product of his suggestion, and had the benefit of his counsel and participation.

Out of this unusual series of papers came a great multitude of facts and suggestions which will help to show in their true light

the real place of agriculture and the factors of its future development. Broad principles were dealt with largely and there was little by way of didactic, not to say dogmatic, setting forth of what would be or should be, for it was a conference and it dealt with too large a question to formulate final conclusions in two days' time. Its announced purpose was "to encourage interest" in the development of an agricultural program rather than to definitely formulate one at that time. Instead, a committee was appointed at the conclusion of the conference to consider the propositions advanced and discussed, and to report at as early a date as compatible with thorough consideration whatever recommendations or proposals appear to be helpful in determining the general direction of agricultural development. And in accordance with the traditions of the university that "in all real development it is the thinking citizen and not his institutions that must take the lead," this committee was appointed from the people, all but 2 of the 14 members being outside the university.

The disturbed condition of agriculture made it difficult to safely predict the future, but a forward look was taken by several on the basis of the apparent trend of circumstances. As was shown, the industrial growth of the State may lead to its agriculture being more largely devoted to supplying the home market; and as the value per acre and per farm has increased and will probably still further increase, there must be a larger output per farm or per acre in order to make the investment pay. This will call for conserving and if possible increasing fertility; and beyond this, profitable cultivation must be more intensive and the hazards reduced.

President Kinley summed up the situation by the observation that a point has been reached in agriculture where the raising of larger crops per unit must be expected at increased cost. "If in our attempt to raise our crops on high-priced soil at increasing costs we find ourselves unable to compete with people raising similar crops on cheaper land in other parts of the world, we shall be obliged either to resort to a system of protection for agriculture or we shall have to let part of our land go out of use. . . . We must seek that kind of agricultural activity in which we are most efficient under our Illinois conditions. We must make the most economical use possible of our land and machinery."

He prophesied that "in a general way we are heading toward a more intensive agriculture, toward a standard or model farm having one leading agricultural activity and numerous auxiliary agricultural processes, each of them yielding its own profit and all together yielding a larger joint profit than would be obtained from the pursuit of a single agricultural activity on that particular farm. We shall have larger crops per acre and in time either higher prices for them or reduced costs of producing them. We shall put our

dairying as a separate industry on a firmer basis, and we shall make it a part of the work of every farm. We shall reclaim our waste lands and use them for forests and grazing. We shall restore our cattle industry by finding some method of low cost feeding and we shall improve our economic organization and make social conditions more attractive."

In all these things he pointed out the opportunity and duty of the university to assist by its studies and discoveries. "The agricultural experiment station will have to widen its activities to include some economic and social aspects, and it will probably find it advantageous to change the direction of its studies in connection with fertility so as to add to them investigations in plant life that will enable us to get more healthy plant products and more of them at the same cost."

The consideration of conditions and tendencies presented at this conference supplied a very helpful basis for outlining a constructive program for agricultural investigation. The various angles from which the subject was presented contributed to this in an unusual degree. Rarely has such a thoughtful survey been undertaken.

Many questions on which more definite and complete information is needed were propounded in several of the papers by practical men of the soil. These are suggestive for investigation, but beyond this they illustrate the attitude of such men and their present reliance on investigation. They are not afraid, either, of such work being too technical for their benefit. To quote from one of them: "There has hardly been a time when we needed to have so much experimenting done for us. In so far as our inquiries are in the interest of public welfare, we have a right to ask the consuming public to help us solve our problems by helping to support our college and experiment station. It is the duty of the public to help to provide research workers who may in any way help to reduce the cost of living. . . . It is only after disinterested scientific investigation by trained workers that the farmer can afford to venture far upon untried enterprises."

In agronomy the importance of studies in the physiology of crop plants was strongly emphasized by several speakers—the study of function, of what living things do, as well as how they are constructed. Indeed, the principal agricultural problem in crop production was defined as being "the way in which living things perform their normal function day by day and the conditions necessary to successful growth." As one speaker put it: "Valuable as are the vitamins, important as is the rôle of the amino acids, there is yet even greater significance in those vital activities which do not lend themselves to chemical analysis but must be studied by direct methods brought to bear upon the animal or the plant at work and discharging its normal function."

The importance of investigation in breeding and feeding as means of economizing was also given prominence, together with the restoration of stock breeding to its former position in the State. The suggestion was made for a thorough testing of present standards for the selection of animals for various purposes, such as meat, milk, and work, and the lack of much progress was mentioned in developing practicable methods of measuring the efficiency of breeding animals of the meat-producing types. In nutrition the opportunity for fundamental research was pointed to, and studies were mentioned which should concern themselves with the energy requirements of sheep, swine, and horses, the factors which modify these requirements, particularly the age of the animal, its size, condition, and the atmospheric conditions; the efficiency of the horse in the performance of different kinds of farm operations; and the efficiency of the conversion of the energy of feeds into meat, milk, and work, particularly as affected by light, medium, and heavy rations.

In solving the problems of live-stock production, large reliance was placed on the use of economics. "We must learn to fit our live-stock operations into systems of farming so that they will utilize, not only our surplus, but also the by-product feeds of the farm which would otherwise ordinarily go to waste. We must not allow our live-stock operations permanently to take out of the cropping system land that can better be utilized for grain production. In other words, any attempt to preserve a phase of agriculture when its preservation is uneconomic is a shortsighted policy and indefensible."

A logical conclusion to the conference was a quite broad philosophical discussion of the whole situation by Dean Davenport, with consideration of the ultimate effects of some of the tendencies if allowed to go uncurbed. In this he took up the large question of the efficient use of land, the menace of "irresponsible tenantry in which the owner and the tenant conspire to operate the farm for immediate results, at the expense both of fertility and of typical American country life"; and the "great struggle" developing between the country and the town. The latter was attributed to the difference between working for "goods," as the farmer does, and for money, profit, and a living, as the city, the capitalist, and the laborer do, with attendant conditions which operate to inordinately increase the cost of standard necessary commodities essential to the city and the country alike.

The field of credit was cited as another cause of the gulf forming between the country and the town, many capitalists failing to appreciate the financial side of farming. Dean Davenport argued that the city man has much to do in closing up this gap, both in the field of production and in the handling of capital, and that he can not arrogate to himself either the standards of production or the

exclusive use of the capital which everybody has helped to produce. And in this field, hitherto considered exclusively commercial, a great work was seen for the agricultural colleges, not only for the further enlightenment of farmers but for the enlightenment of other classes as well.

From the standpoint of economics and its broader relations to research in agriculture the need was maintained for a generation of students trained from the ground up in the application of the essential principles of economics to the serious business of farming and its relation to the world of commerce and finance. "We need," he said, "new agricultural specialists trained to think in terms of economics."

With reference to the future outlook, a new agriculture in the Mississippi Valley was predicted, and what this shall be like and the character of the civilization which it shall form a part of will depend very much, it was maintained, upon the vision possessed by the farmer now and in the immediate future. To make it profitable, scientific and economic studies must be prosecuted assiduously in order to furnish the facts upon which leaders must depend for successful practice. This new agriculture "will depend also upon the degree of understanding and of cooperation which can be maintained between thinking citizens, who must take the lead, and the university, which is the public agent for investigating the knotty problems continually arising in a rapidly developing civilization.

This puts squarely up to the college and the State the large, important place of the experiment station in working out the future of agriculture, and to the latter an unusually broad and logical conception of its proper field. It is seen as the primary factor in forecasting and paving the way for a broad agricultural policy, suited not only to the producers in its class but to that greater class, the whole people, who, in the last analysis, are no less dependent upon this national industry. What is taught in the colleges and among the people and the steps that are taken by those who exercise leadership must rest, if sound, upon thorough, unbiased investigation, biological, economic, and sociological. Such a view should help greatly toward the framing of a well-directed, purposeful program for the future of these institutions and reenforce the argument for their adequate support.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

Effect of certain antiseptics upon the activity of amylases, H. C. SHERMAN and M. WAYMAN (*Jour. Amer. Chem. Soc.*, 43 (1921), No. 11, pp. 2454-2461).—This reports a study of the influence of toluene, formaldehyde, and copper sulphate upon amylases of both animal and vegetable origin and when tested in both natural and purified forms. The method employed consisted in allowing a suitable amount of the amylase solution to act upon 100 cc. of 2 per cent starch paste, with and without the antiseptic, to be tested in the presence of suitable activating salts for 30 minutes at 40° C., and estimating the reducing sugar formed in the action of the amylase upon the starch by heating with an excess of Fehling solution. The results are expressed in terms of milligrams of cuprous oxid reduced, after making allowance for the reduction resulting from the starch or starch and antiseptics as determined by blank tests. The results obtained may be summarized briefly as follows:

Low concentrations of chloroform had no effect upon commercial pancreatin or malt extract, but did affect the purified preparation of these amylases. Toluene had little influence upon either the commercial or purified amylases. Formaldehyde, even in small amounts, was injurious to commercial pancreatin, purified pancreatic amylase, saliva, malt extract, purified malt amylase, commercial takadiastase, and the purified amylase of *Aspergillus oryzae*. Takadiastase was the least, and purified pancreatic amylase the most affected. The percentage of loss of enzym action increased in all cases with increasing concentration of formaldehyde.

All of the enzymes studied were also very sensitive to copper sulphate, pancreatic amylase to the greatest degree. "The percentage loss of enzym action due to formaldehyde and to copper sulphate solution did not depend upon the ratio of antiseptic to enzym or of antiseptic to substrate, but upon the ratio of antiseptic to water, or the concentration of the antiseptic in the system. The results demonstrate the need of attention to the possible effects of antiseptic upon enzym in cases in which antiseptics are used to suppress microorganisms in studies of enzym activity. The much greater sensitiveness of the amylases to formaldehyde and copper sulphate than to toluene is of further interest in connection with the problem of the protein nature of these enzymes."

The influence of certain amino acids upon the enzymic hydrolysis of starch, H. C. SHERMAN and F. WALKER (*Jour. Amer. Chem. Soc.*, 43 (1921), No. 11, pp. 2461-2469).—The authors' investigation of the influence of amino acids upon the rate of hydrolysis of starch by enzymes (*E. S. R.*, 42, p. 203) has been extended to glycine, alanine, tyrosine, and phenylalanine.

All of these acids were found to cause an undoubted increase in the rate of hydrolysis of starch by purified pancreatic amylase, commercial pancreatin, saliva, or purified malt amylase, and less marked results with the less sensitive enzym materials malt extract, takadiastase, and an *Aspergillus* amylase pre-

pared in the laboratory from takadiastase. Each of the above acids, as well as aspartic acid and asparagin previously studied, showed a similar influence upon the enzymic hydrolysis of the starch, and a mixture of two of these acids caused no greater effect than would result from the same concentration of one of them alone.

In seeking to explain the favorable effect of the added amino acid, it is shown that it is not due to any influence upon H-ion concentration or upon the combination of the amino acid with the product of the enzymic reaction. The observation that the addition of one of these acids serves to protect the enzyme from the harmful effect of copper sulphate, noted in the above paper, is thought to indicate that the favorable influence of the amino acid is due, in part at least, to a protection of the enzyme from deterioration.

A study of the influence of arginin, histidin, tryptophan, and cystin upon the hydrolysis of starch by purified pancreatic amylase, H. C. SHERMAN and M. L. CALDWELL (*Jour. Amer. Chem. Soc.*, 43 (1921), No. 11, pp. 2469-2476).—The study of the effect of amino acids on the enzymic hydrolysis of starch has been extended to arginin, histidin, tryptophan, and cystin. Preliminary experiments having shown that arginin, histidin, and cystin interfere with the determination of reducing power by Fehling solution, the amylolytic power of the amylase was measured, using the procedure based on the method of Wohlgemuth as previously described.¹ Two preparations of arginin obtained from gelatin and two of histidin, one from gelatin and the other from casein, were compared with reference to their influence upon the action of the enzyme with the monamino acids glycine and phenylalanine, with one another, with purchased preparations of histidin and tryptophan and with cystin.

Arginin and cystin were found to influence favorably the digestion of the starch, while histidin and tryptophan did not. Since the tests were all controlled as to H-ion concentration, it is considered established that the influence of the amino acid is not simply a matter of buffer effect. The fact that the amino acids here studied differed among themselves in their effect upon enzymic hydrolysis is thought to indicate "that there are specific effects, probably though not necessarily connected with differences of structure, which may offset the favorable influence uniformly shown by the monamino acids studied previously."

New methods for estimating enzymatic activities of duodenal contents of normal man, C. W. MCCLURE, A. S. WETMORE, and L. REYNOLDS (*Arch. Int. Med.*, 27 (1921), No. 6, pp. 706-715).—In the methods described uniformity and proportionality of the enzymatic activity are considered to have been obtained by the use of phosphate mixtures as buffers. The extent of proteolytic and amylolytic enzyme action is determined by an application of the methods of Folin and Wu for the determination of nonprotein nitrogen and of sugar in the blood (*E. S. R.*, 41, p. 13), with the modification that metaphosphoric acid is used as the protein precipitant. The extent of lipolytic enzyme action is estimated by determining the degree of acidity developed in a true emulsion of cottonseed oil by titrating while hot with alcoholic potassium hydroxide solution, using phenolphthalein as an indicator. The technique of the method is described in detail, data are given on the application of the method, and factors which have to be considered in the development of the technique are discussed.

Hydrogen ions, titration, and the buffer index of bacteriological media, J. H. BROWN (*Jour. Bact.*, 6 (1921), No. 6, pp. 555-570, fig. 1).—The author discusses the significance of both titration and H-ion concentration determinations

¹ *Jour. Amer. Chem. Soc.*, 37 (1915), No. 3, pp. 634-643.

of culture media and the importance of a knowledge of the buffer content of the media. The buffer content between stated limits of H-ion concentration is defined as the buffer index, which is the sum of the reserve acidity and reserve alkalinity of the medium between those limits. The reserve acidity is defined as the amount of alkali required to reduce the H-ion concentration of the medium from its initial reaction to a stated lower H-ion concentration, $\text{pH}=8.0$, and the reserve alkalinity as the amount of acid required to raise the H-ion concentration from its initial reaction to a stated higher H-ion concentration, $\text{pH}=5$.

The buffer index may be determined colorimetrically by determining the original H-ion concentration of the medium and titrating with standard $\text{N}/20$ alkali to $\text{pH}=8$ in one sample and with $\text{N}/10$ acid to $\text{pH}=5$ in another sample. The sum of the two values will then indicate the buffer index. A copy of instructions for laboratory helpers and a convenient form of record on which is recorded a sample titration are appended.

Colorimetric analysis, F. D. SNELL (*New York: D. Van Nostrand Co., 1921, pp. VIII+150, figs. 16*).—This reference book on colorimetric analysis contains three general chapters dealing, respectively, with conditions of use of colorimetric methods, apparatus used and methods of using it, and calculation of results. These are followed by chapters dealing with the application of colorimetric methods to the determination of various metals, nonmetals, and acid radicals, and a final brief chapter on nephelometry. Illustrations are included of several types of colorimeters.

The microdetermination of nitrogen and its biological applications, M. POLONOVSKI and C. VALLEE (*Ann. Chim. Analyt., 2. ser., 3 (1921), No. 12, pp. 363-366, fig. 1*).—Previously noted from another source (*E. S. R., 46, p. 12*).

On the use of the conventional carbon factor in estimating soil organic matter, J. W. READ and R. H. RIDGELL (*Soil Sci., 13 (1922), No. 1, pp. 1-6*).—Determinations of the carbon content of the organic matter of 37 soils secured from seven different experiment stations were made by the rapid dry combustion method for the simultaneous determination of soil organic matter and organic carbon (*E. S. R., 45, p. 614*), and similar data were secured for the corresponding sub- and sub-surface soils.

The percentage of organic carbon in the surface soils varied from 30.20 to 56.27, with a general average of 49.26 as compared with the usual assumption of an average carbon content of 58 per cent. The average carbon content of the sub- and sub-surface soils of the same samples was 39.16 per cent. The data on 13 soils selected at random from the above list were compared with calculated determinations on the basis of 58 per cent carbon, 49.26 per cent carbon, and 6.24 per cent nitrogen. The deviation values of the calculated determinations were the least significant in the case of data obtained with the use of the nitrogen factor. The authors are of the opinion that the adoption of a conventional nitrogen factor would give more reliable information regarding the organic matter content of a soil than the use of an arbitrary carbon factor.

Studies on the proposed method of determining the iodine number of fats by means of a solution of iodine monochloride in carbon tetrachloride, B. M. MARGOSCHES and R. BARU (*Ztschr. Angew. Chem., 34 (1921), No. 70, Aufsatz., pp. 454-456*).—A comparative study is reported of the Hübl, Wijs, and Hildt² methods of determining the iodine number of fats. In the latter method a solution of iodine monochloride in carbon tetrachloride is used as solvent. The results obtained show that only by using an insufficient excess of halogen do the results fail to agree with the standard methods. To obtain concordant results the technique must be followed closely.

² Rev. Prod. Chim. [Paris], 21 (1918), No. 16, pp. 254, 255.

Olive oils and the reaction of Villavecchia, J. PRAX (*Ann. Falsif.*, 14 (1921), No. 153-154, p. 270).—Attention is called to the fact that certain olive oils, particularly Tunisian oils, give a red color with the Villavecchia reagent which can be confused with that given by olive oils adulterated with sesame oil. A substitute method for detecting sesame oil is recommended as follows:

Ten cc. of the oil is shaken vigorously with 10 cc. of a 10 per cent ammoniacal solution of alcohol at 90° C. The mixture is then heated for 5 minutes on the boiling water bath to evaporate the alcohol and ammonia. In the absence of sesame oil no color is produced, but in the presence of sesame oil even in as small amounts as 1:1,000 a characteristic red color is produced.

A method for determining lime in dairy products, T. MOJONNIER (*Jour. Dairy Sci.*, 4 (1921), No. 5, pp. 453-455).—A rapid method of determining lime in dairy products after the separation of fat by either the Babcock or the Mojonnier method is described.

In the former method 18 gm. of the material in the case of whole milk, skim milk, buttermilk, and whey, or 9 gm. in the case of evaporated milk, condensed milk, ice cream mix, and cream are weighed into clean Babcock test bottles, and, when necessary, sufficient distilled water is added to bring the total weight up to 18 gm. About 15 gm. of C. P. sulphuric acid is added slowly with constant shaking and the bottles are centrifuged for about 10 minutes, after which sufficient distilled water is added to float off the fat and the centrifugation repeated until the last visible traces of fat are gone. The solution is then washed out into a beaker with three successive small portions of distilled water, and two volumes of 95 per cent alcohol are added. After having stood overnight the precipitate is filtered on a Gooch crucible with asbestos, washed with alcohol, dried thoroughly, and ignited at a moderate temperature to a constant weight.

If the fat has been extracted by the Mojonnier process the residue remaining in the fat extraction flask is neutralized with C. P. sulphuric acid, 10 cc. additional sulphuric acid is added, together with two volumes of 95 per cent alcohol, and the method continued as described above. Results obtained by means of this method in the case of different dairy products are presented. It is noted that the method does not apply in the case of sweetened condensed milk or other products containing large amounts of sugar, on account of the solubility of calcium sulphate in sucrose solutions.

Individual variation as influencing Rehfuß fractional method of gastric analysis, N. KOPELOFF (*Jour. Amer. Med. Assoc.*, 78 (1922), No. 6, pp. 404-409, figs. 3).—This is a report of some critical studies of the Rehfuß fractional method of gastric analysis.

Repeated analyses on the same individual within a short time were found to yield curves which varied as much from one another as the differences between the curves of different individuals. Variations in the highest point on curves from the same individual and in the total amount of fasting contents from the same individual often exceeded corresponding figures for different individuals.

A comparison of the titratable acidity with the true acidity in terms of H-ion concentration showed an agreement in only about 80 per cent of the cases. The latter determination is considered to yield more valuable information regarding the true acidity of the gastric contents.

In only about half the cases was there any correlation between high gastric acidity and low bacterial count. It is suggested that the bacterial count of the stomach contents depends largely on the swallowing of saliva.

The production of furfural by the action of superheated water on aqueous corn cob extract, F. B. LAFORGE (*Jour. Indus. and Engin. Chem.*, 13 (1921), No. 11, pp. 1024, 1025).—This paper from the Bureau of Chemistry,

U. S. D. A., describes a method of treating corncobs in such a way that the cellulose material can be obtained and in addition an amount of furfural corresponding to 7.76 per cent of the weight of the original cobs. The method consists essentially in heating the cobs under pressure for a short time with hot water. When the pressure is released an amount of furfural corresponding to about 2.8 per cent of the weight of the cobs is blown off, together with a certain amount of water. The crude cellulose residue is then filtered and pressed, and the filtrate, which contains a considerable amount of soluble carbohydrates, is heated with water under pressure, thus causing hydrolysis and the formation of a further amount of furfural. This process is considered superior to the process previously described (E. S. R., 45, p. 510) in that the time necessary for handling a given amount of cobs is shortened, the cellulose is saved, and water in place of acid is used for the hydrolysis.

It is thought that the method can also be applied to the preparation of furfural from cornhusks, cornstalks, and bagasse, and probably from other plant materials rich in pentosans.

METEOROLOGY.

Handbook of meteorology, J. W. REDWAY (*New York: John Wiley & Sons, Inc., 1921, pp. V+294, figs. 61*).—This was prepared as a textbook "for the use of cooperative observers and for the instruction of students in meteorology and aeronautics. It is essentially a laboratory manual." It is divided into two parts, the first part being mainly an elementary synopsis of the general principles of air science; the second, which is specifically designed for the use of cooperative observers and students, describes the instruments used in meteorology and the construction and care of them. The first part contains a chapter on the dust content of the air, which summarizes in part the researches of the author in this field. An appendix gives conversion and other useful tables.

The significance of cirrus in forecasting weather, P. SCHERESCHESKY and P. WEHRLÉ (*Compt. Rend. Acad. Sci. [Paris], 174 (1922), No. 5, pp. 314-316, fig. 1; abs. in Rev. Sci. [Paris], 60 (1922), No. 4, p. 135*).—This article completes the concept of cloud systems previously noted (E. S. R., 45, p. 418), and further discusses the relation of cirrus thereto, stating that the presence of cirrus is an indication of the proximity of a cloud system, but does not necessarily signify what part of the system is likely to pass a given station. For this purpose it is indispensable for the meteorologist to have synoptic charts, by means of which he can determine the position with relation to the station of the cloud system as well as the direction and velocity of its movement.

[Meteorological observations in Trinidad and Tobago] (*Trinidad and Tobago Rpts. Dept. Agr., 1919-1920, pp. 76-84*).—Tables are given which record observations on pressure, temperature, rainfall, and humidity at the Botanic Gardens and other places in Trinidad and Tobago. The records given of rainfall at the Royal Botanic Gardens, Port-of-Spain, Trinidad, cover the period from 1862 to 1920, inclusive. The records of temperature and pressure at this place cover the period 1888-1920.

Meteorological observations, 1920, P. NELSON (*Guam Sta. Rpt. 1920, pp. 77-79*).—Observations on pressure, temperature, rainfall, and velocity and direction of the wind are summarized for the year ended June 30, 1920. The weather conditions during the year were normal except for rather excessive rainfall in August and September. The mean temperature of the year was 81.76° F.; the maximum temperature, 99.5° February 3; the minimum, 73° May 5 and 6. The total precipitation was 90.89 in.

[The drought of 1921 at Kew], W. B. TURRILL ET AL. (*Roy. Bot. Gard. Kew, Bul. Misc. Inform., No. 1* (1922), pp. 1-15).—This drought is stated to have been "unprecedented in the memory of living man," the rainfall for the year being far below the average. It was "most unfavorable for the cultivation of hardy trees and shrubs." As a result of deficient rainfall, the flow of the Thames was greatly reduced, and the water secured from it for the irrigation of the gardens contained an abnormal and injurious amount of saline matter.

On the climatology of Morocco, L. GENTIL (*Compt. Rend. Acad. Sci. [Paris]*, 174 (1922), No. 5, pp. 311-313; *abs. in Rev. Sci. [Paris]*, 69 (1922), No. 4, p. 185).—This article reports results of a study of the rather limited data on the climate of Morocco with reference to its influence on the morphology of the soil and on the distribution of plants and floral associations. Interesting relationships of winds and of reliefs to the geobotanic characteristics of the region are also brought out. The sources of climatological data are cited.

SOILS—FERTILIZERS.

Analyses of soils of Meriwether County, W. A. WORSHAM, JR., D. D. LONG, L. M. CARTER, M. W. LOWRY, and W. O. COLLINS (*Ga. Agr. Col. Bul.* 228 (1921), pp. 40, pl. 1, fig. 1).—This supplements the report of the soil survey made in cooperation with the U. S. D. A. Bureau of Soils (E. S. R., 38, p. 718). It presents and discusses analyses of the representative soil types of the county, of which more than 85 per cent are of residual origin.

The analyses indicate that, with the exception of small and comparatively unimportant areas of fine sandy loam and gravelly loam, the soils are well supplied with potash, but that practically all of the upland soils are deficient in phosphoric acid and nitrogen, especially the light sandy types. The use of lime is also necessary in certain cases. While deep plowing and subsoiling appear to be necessary, it is stated that but little benefit will result from these practices unless the supply of organic matter in the soil is maintained and increased.

Analyses of soils of Lowndes County, W. A. WORSHAM, JR., D. D. LONG, L. M. CARTER, M. W. LOWRY, and W. O. COLLINS (*Ga. Agr. Col. Bul.* 242 (1921), pp. 40, pl. 1, figs. 3).—This supplements the report of the soil survey made in cooperation with the U. S. D. A. Bureau of Soils (E. S. R., 44, p. 211). It presents and discusses analyses of the representative soil types of the county. The analyses indicate that the soils are uniformly deficient in nitrogen and organic matter, phosphoric acid, and potash. Liming is also necessary in certain localities. The value of deep plowing on such of the soils of the county as have heavy clay subsoils is emphasized.

Bureau County soils, J. G. MOSIER, S. V. HOLT, E. VAN ALSTINE, and F. W. GARRETT (*Illinois Sta. Soil Rpt.* 20 (1921), pp. 72, pls. 3, figs. 12).—This survey deals with the soils of an area of 553,106 acres in the west central northern part of Illinois, and reports analyses and field experiments to determine the fertility requirements and crop adaptations of the prevailing types. The topography varies from hilly to flat. The county originally contained a large area of swamp land, which has recently been drained.

The soils of the county are grouped as upland prairie, upland timber, terrace. The soil is fairly free from stones and contains relatively large proportions of soil is the most extensive type, covering 53.41 per cent of the area.

Representative Transvaal soils, I-III (*Union So. Africa Dept. Agr. Jour.*, 1 (1920), No. 8, pp. 722-727; 2 (1921), No. 2, pp. 170-176; 3 (1921), No. 4, pp. 337-342).—Three reports of the soils of the Transvaal have so far been received.

I. The Koedoespoort red loam, B. de C. Marchand (pp. 722-727).—The Koedoespoort loam is a brick red to red-brown sandy clay soil, usually deep and easily

cultivated. The subsoil is usually a brighter red than the surface soil and is always stiffer. The typical soil is sedentary.

Chemical analyses of these soils show that they contain a high percentage of iron oxid and alumina. The ferric oxid is usually in excess, and a comparatively large proportion of it is present in a very finely divided state. The soils are deficient in lime and available phosphoric acid and contain average percentages of potash and nitrogen. The predominant mechanical fractions in soils of this type are clay, sand, and fine sand.

Fertilizer experiments with maize, beans, and potatoes indicated that the application of phosphates is essential for good crop production, and that nitrogenous and potassic fertilizers are of little use. It was also found that insoluble phosphates gave the best results in the long run. If superphosphate is used lime should also be applied. The incorporation of organic matter to maintain tilth and the supply of soil nitrogen is considered desirable.

II. *Pretoria quartzite sandy soils*, B. J. Smit (pp. 170-176).—The quartzite soils in the Pretoria District of the Transvaal are red or brown to light gray very sandy soils and are derived from the quartzite rocks which consist chiefly of quartz grains cemented together with silica. Mechanical analyses showed that the soils consist mainly of particles between 0.25 and 1 mm. in diameter. Chemical analyses showed that these soils are deficient in all the essential plant nutrients and are considered to belong to the poorest class of soils in the Transvaal. They are particularly deficient in nitrogen and available phosphoric acid, and with certain exceptions their potash content is also very low.

Plat fertilizer experiments with maize and cowpeas showed that where cowpeas were grown in the first year much better results were obtained in the second year with maize than where maize followed maize.

The general conclusions drawn from these experiments are that the best fertilizer for quartzite soils is one containing phosphoric acid, and that since the soils also require lime, basic slag is the best form in which to apply it. It is also concluded that it is more profitable to enrich these soils with nitrogen by growing leguminous crops than by applying nitrogenous fertilizers. These results were verified by further experiments with wheat.

III. *The Norite black turf*, B. J. Smit (pp. 337-342).—Results of studies of the so-called Norite black turf soil which occurs in the Pretoria, Rustenburg, Lydenburg, Middelburg, Marico, and Waterberg districts are reported. This soil is gray black to blue black in color and is usually over 3 ft. and rarely less than 2 ft. deep. There is no apparent marked difference between the surface soil and that lower down, except that the latter is almost always a shade lighter in color and heavier in texture. Below the surface foot the soil is classified as a heavy clay.

Mechanical analyses indicated that the overwhelming predominance of the clay fraction is the most striking feature, and that the sand and silt fractions are quite subordinate. The percentage of clay varies in the first foot from 39 to 50, while in the second and third foot it varies from 46 to over 54 per cent. The soil is fairly free from stones and contains relatively large proportions of carbonates with small limestone nodules visible to the naked eye in the majority of cases.

Chemical analyses showed that the outstanding chemical characteristic of this soil is the high proportion of calcium carbonate. The percentages of total lime are also high, and the percentages of magnesia are much lower than those of lime. These soils are as a rule said to be well supplied with total potash, while the reserve of phosphoric acid is decidedly low. It was found in determining the availability of the potash and phosphoric acid content that the pro-

portion of potash shown as available is depressed to a greater or less extent according to the amount of carbonates present. The opposite appeared to be true in the case of phosphoric acid. While the percentages of nitrogen and organic matter in the soil appeared to be low, it did not seem to require a nitrogenous fertilizer.

The opinion is expressed that the only fertilizer which will give profitable returns on this soil is one containing phosphates, and that treatment to improve the textural condition should be the first consideration.

Soils (*India [Dept. Agr.] Rev. Operations, 1919-20, pp. 41-44*).—In a survey of the soils of India it has been found that the soils of the Godavari delta in Madras indicate a deficiency of nitrogen in 40 per cent of the cases and of phosphoric acid in about 25 per cent.

Studies of the carbon-dioxid content of the soil air in the botanical area at Pusa showed the percentage of carbon dioxid to be highest in the grassed plat and lowest in the cultivated plat.

Studies at Assam on the influence of calcium carbonate on the biochemical processes of the soil showed that ammonification and nitrification were very much improved. However, no nitrification took place under any conditions when the percentage of soil moisture was raised to 23, thus emphasizing the importance of good drainage. Estimations of soil nitrogen at Jorhat indicated less loss of soil nitrogen from the limed plats by means other than crop removals and the activity in limed soil of some nitrogen recuperating agency. The great length of time over which an initial application of lime continues to influence cropping favorably was also indicated. Small and more frequent lime dressings give better results than large and less frequent dressings. It was also found that it does not pay to incorporate lime too deeply for most farm crops.

Studies at Pusa on the nitrification of cow dung, cow urine, and sheepfold manure showed that when cow dung was added to the soil in the fresh state no nitrate accumulation took place, but that when added after storing under either aerobic or anaerobic conditions about one-third of its nitrogen was converted into nitrate. The urine nitrogen was rapidly converted into nitrate in the soil. The inhibiting effect of an excess of carbohydrate on nitrification was indicated when straw was added with the dung or urine. It was also found that the loss of nitrogen in urine during storage can be avoided by storing it under anaerobic conditions maintained by covering the urine with a very thin layer of kerosene oil.

A study of the wide variations in the accumulation of nitrates during the decomposition of various oil cakes in Pusa soil led to the conclusion that they are due to the differences in the relative proportions of carbohydrates and nitrogen in the cakes. The oil content had a very slight influence on nitrification, but the addition of such materials as cellulose, filter paper, sawdust, starch, cane sugar, and glucose to cakes rich in nitrogen retarded the accumulation of nitrate. In the case of Mahua cake (*Bassia latifolia*) no nitrate was found after eight weeks' incubation, except when the cake had been previously fermented.

Studies on the nitrogen content of fallowed and cropped soils at Pusa showed that the nitrate and organic nitrogen contents of the cropped soils were lower than those of the fallowed soils, and the differences were greatest during the period of the most active growth of the crop.

Experiments on the effect of accumulated products of the metabolism of *Azotobacter* on its nitrogen-fixing power showed that these products apparently appreciably lower the amount of nitrogen fixation.

Soils, G. BRIGGS (*Guam Sta. Rpt. 1920, pp. 44-46*).—The results of general soil fertility studies at the station are briefly summarized, particular reference being made to tests with commercial fertilizers, local fertilizer products, manures, and green manures.

Tillage experiments in 1919, J. VAN DIJK (*Meded. Deli Proefsta. Medan, 2. ser., No. 11 (1920), pp. 1-12*).—Studies on the influence of different depths of plowing on white clay tobacco soils are reported. The different plats were plowed 14 and 20 in. deep (1) one year before planting, (2) one year and one-half year before planting, and (3) one-half year before planting.

The best results were obtained with tobacco when plowing 20 in. deep a half year before planting. There was not a great difference between these results and those obtained when plowing 20 in. deep a year before planting and 14 in. deep a half year before planting. No conclusions are drawn.

Soil sterilization for plant house, G. BRIGGS (*Guam Sta. Rpt. 1920, p. 47*).—The preliminary results of tests of steam sterilization of soil indicated that such sterilization will largely control damping-off of plants in plant houses at the station and destroy weed seeds. The sterilized soil was loose and showed a tendency to dry out quickly, whereas the unsterilized soil ran together and held moisture much better.

Action of acid humus on biological occurrences in soil and water, H. FISCHER (*Centbl. Bakt. [etc.], 2. Abt., 54 (1921), No. 20-24, pp. 481-486*).—Experiments are reported which led to the conclusion that favorable conditions for nitrogen fixation are afforded by the combined action of green plants and nitrogen-fixing bacteria in neutral and weakly acid media, while under the same experimental conditions the acid humus of upland moor soils will suppress nitrogen fixation.

Gases which result from the decomposition of *Astragalus sinicus* in rice fields, I. ONODERA (*Ber. Ohara Inst. Landw. Forsch., 1 (1920), No. 5, pp. 557-578, pl. 1, figs. 3*).—Pot and field experiments are reported which showed that when *A. sinicus* is added to rice soils as a green manure great quantities of gas result from its decomposition which consist mainly of methane, carbon dioxid, nitrogen, and some hydrogen. Hydrogen usually disappears toward the end of the decomposition process. Often a little oxygen appears, but this is apparently a product of the assimilation of carbon dioxid by algae.

When this green manure is used, the gas coming from the subsurface layers of rice soils has higher methane and carbon-dioxid contents than that from the top layers. The carbon-dioxid content is considerably greater in the subsurface layers. The reverse is true in regard to the nitrogen content.

It was found that the decomposition of *A. sinicus* is more rapid in sand soil than in loam and clay soils, and that the gas development is more quickly completed in sand soil. The decomposition is slowest in clay soils.

Phosphoric acid in humus sandy soils and in their solutions, C. BRIOUX (*Ann. Sci. Agron. Franç. et Étrangère, 6. ser., 37 (1920), No. 1, pp. 80-86*).—A rather general study of the nature of the phosphoric acid in humus sandy soils is briefly described. It is concluded that when such soils are enriched by intensive cultivation they contain much more soluble phosphoric acid than is generally admitted, and frequently sustain appreciable losses of humus and phosphoric acid in drainage waters.

Practical significance of the organic carbon-nitrogen ratio in soils, J. W. READ (*Soil Sci., 12 (1921), No. 6, pp. 491-495*).—Studies conducted at the Arkansas Experiment Station on the significance of the organic carbon-nitrogen ratio in its relation to soil productivity are reported.

Thirty-seven different soils were used, of which 16 contained less than 3 per cent of organic matter and showed a carbon-nitrogen ratio which ranged from

4.51 to 9. The yield in bushels of corn per acre varied from 24 to 50 on soils whose ratios were 7.74 and 7.71, respectively. The remaining 21 soils, having above 3 per cent of organic matter, showed a variation of from 6.32 to 10.74 in the ratio of carbon to nitrogen, and the yield of corn given for each of these extremes was 40 and 45 bu., respectively. The ratio for the lowest yield of corn on the 21 soils, 23 bu. per acre, was 10.57, while that for the highest yielding soil, 53 bu. per acre, was 8.64.

It is concluded that soil productivity can not be correlated with the organic carbon-nitrogen ratio.

Nutrient requirements of clover and wheat in solution cultures, J. J. SKINNER and F. R. REID (*Soil Sci.*, 12 (1921), No. 4, pp. 287-299, figs. 6).—In a contribution from the U. S. Department of Agriculture, studies in aqueous culture solutions on the nutrient requirements of clover and wheat and the ratio of phosphate, nitrate, and potassium best suited for their growth are reported.

The triangular plan of preparation of solutions was used. In studies with young wheat plants, using the complete triangle set of 66 solutions, the better growth occurred when all three nutrient elements phosphate, nitrate, and potash were present in the solution. The best growth was obtained in the mixtures which contained from 10 to 30 per cent of phosphate, from 30 to 60 per cent of nitrate, and from 30 to 60 per cent of potash. The growth in solutions containing all three elements was much greater than that in solutions containing two elements.

The cultures producing the maximum clover growth contained a slightly higher proportion of potash and a slightly lower proportion of nitrogen than the cultures which produced the maximum growth of wheat. The clover absorbed a slightly higher ratio of potash than wheat, the difference being naturally more marked in those solutions containing a higher proportion of potash and nitrogen than phosphate. The clover required a smaller proportion of nitrogen than the wheat. Conversely the wheat absorbed and apparently required for its maximum growth a higher ratio of nitrogen than clover.

These results are taken to indicate that normally clover is a potash-loving plant, and that it requires a higher proportion of potash than of nitrogen or of phosphate in its metabolism.

Pot culture experiments, 1920, J. A. VOELCKER (*Jour. Roy. Agr. Soc. England*, 81 (1920), pp. 267-278, pls. 3; also in *Woburn Expt. Sta. Rpt. 1920*, pp. 17-28, pls. 3).—Studies of the influence of stannous and stannic oxides, chlorids, and sulphates on wheat showed that tin as a metal appears to have no direct action upon vegetation. Differences shown when using various compounds of tin were found to be due to the acid radical and not to the metal. The oxids of tin showed no marked influence one way or the other in amounts up to 0.1 per cent of tin. The chlorids had a favorable influence in amounts up to 0.1 per cent of tin as stannous chlorid, but in amounts only up to 0.05 per cent of tin as stannic chlorid. The use of 0.1 per cent of tin in the form of stannic chlorid was distinctly toxic. Stannous sulphate had no effect when used in amounts up to 0.1 per cent of tin, but stannic sulphate in the amount of 0.1 per cent of tin was distinctly beneficial.

Experiments on the action of chromium salts upon barley showed that chromium in the forms of chromate or bichromate of potassium is extremely toxic. As little as 0.005 per cent of chromium in these forms prevented the growth of barley.

In studies of the relative effects of lime and chalk on barley and wheat, it was found that lime acted more expeditiously in the neutralization of soil and the production of crops than did chalk. A thousand pounds of chalk per acre proved as effective as did higher quantities. An investigation of the lime

requirement in the soils at the end of the season after the application of lime and chalk showed a striking decrease in all cases.

Studies on the effects of ferrous oxides on wheat, while apparently not giving conclusive results, indicated that ferrous oxid containing 0.1 per cent of iron was not harmful. When used in an amount containing 0.2 per cent of iron, however, it was distinctly injurious. In general lime was found to remedy the injury.

Studies of the influence of silicates on wheat showed that calcium silicate used in amounts up to 4 tons per acre produced a decidedly beneficial effect. Magnesium and aluminum silicates had no influence.

Studies of the influence of sulphur on crops showed no benefit from its use on mustard, red clover, and lucern.

Experiments with fertilizers (*South Carolina Sta. Rpt. 1921, pp. 8, 9, 10-13, fig. 1*).—A more intensive study of the influence of Trona potash and borax on the yield of crops (E. S. R., 43, p. 126) showed that borax, when applied under corn, cotton, cowpeas, and peanuts on a Cecil clay loam soil, produced very marked injury from all rates of application above 10 lbs. per acre. Lime did not prevent the injury.

A test of the sources of potash fertilizers at the Pee Dee Substation showed that the highest yield of seed cotton was secured with 2 per cent of potash in the form of kainit, followed in order by 4 per cent of kainit and 4 per cent of Trona potash. The highest yield of corn was obtained where no potash was used. The next highest yield was obtained with both 2 per cent of potassium carbonate and 2 per cent of potassium chlorid.

A comparative test of various sources of phosphorus showed that acid phosphate gave the best results for both corn and cotton. Tennessee rock phosphate and Florida soft rock phosphate alternated for second place for these two crops, respectively.

In a comparative test of nitrogenous fertilizers at the Pee Dee Substation in 1920 the highest yields of corn were following a mixture of sodium nitrate and cyanamid, and the second best with sodium nitrate alone, while both ammonium sulphate and ammonium nitrate gave good results. With cotton the highest yield was secured with one-fourth sodium nitrate, one-fourth cottonseed meal, and one-half cyanamid, and the second largest yield was secured with one-fourth sodium nitrate, one-fourth ammonium sulphate, and one-half tankage. At the main station in 1920 the highest yield of cotton was secured where cyanamid was used as the nitrogenous fertilizer, care being taken that none of the cyanamid touched the leaves of the cotton plant. The second highest yield was secured from sodium nitrate, and the third from ammonium sulphate.

A general comparative fertilizer test at the Pee Dee Substation has indicated that the earliest and best yields of cotton have been secured with a well-balanced fertilizer, and that nitrogen is the first limiting factor on this soil. Data from a 2-year rotation study with cotton and corn at the substation and from cooperative fertilizer tests are also briefly reported.

Cyanamid in some fertilizer mixtures, W. S. LANDIS (*Jour. Indus. and Engin. Chem.*, 14 (1922), No. 2, pp. 143-145).—The author disagrees with the findings of Harger (E. S. R., 44, p. 421), and describes experiments with samples of commercial fertilizers and special fertilizer mixtures from various plants. The conclusion is drawn that in the ordinary commercial fertilizer, formulated from common fertilizer materials and using cyanamid in the quantities recommended, there is no danger of transformation of the cyanamid to dicvandiamid and consequent loss of the nutrient value of the nitrogen contained.

Manufacture of phosphoric acid and phosphates, J. T. MECKSTROTH (*Chem. and Metall. Engin.*, 26 (1922), No. 2, pp. 77-79).—This is a brief general treatise on the acid decomposition process of the manufacture of phosphates, particularly the monocalcium and dicalcium phosphates.

Briquetting mineral phosphates, W. H. WAGGAMAN, H. W. EASTERWOOD, and T. B. TURLEY (*Chem. and Metall. Engin.*, 25 (1921), No. 11, pp. 517-522, figs. 2).—In a contribution from the Bureau of Soils, U. S. D. A., methods devised for briquetting mixtures of Florida and Tennessee phosphates with reducing agents such as coke, coal, or peat are described.

Utilization of sodium bisulphate in the manufacture of superphosphate, G. GIANOLI (*Gior. Chim. Indus. ed Appl.*, 3 (1921), No. 8, pp. 357-359).—The author draws attention to the large quantities of sodium bisulphate produced during the war, and describes experiments in which raw rock phosphate was treated with a mixture consisting of five-sixths sulphuric acid and one-sixth sodium bisulphate.

While this mixture was quite effective in dissolving the phosphoric acid, it was not nearly so effective as the pure sulphuric acid. It is concluded that a more profitable method of utilization of the sodium bisulphate would result from the refrigeration of an aqueous solution, thus separating the sodium sulphate by crystallization and leaving the dilute sulphuric acid in solution.

Enriching phosphoric acid extracts by means of successive decomposition of additional phosphorite quantities, E. BOBKO and O. SOKOŁOWA (*Ztschr. Angew. Chem.*, 34 (1921), No. 88, Aufsatz., pp. 548-550; *abs. in Jour. Soc. Chem. Indus.*, 40 (1921), No. 33, p. 862A).—Owing to the low solubility of the phosphoric acid of low-grade Russian phosphate rock in dilute sulphuric acid, studies were conducted on the successive decomposition of additional quantities of rock with a view to enriching the extract. In this work finely ground rock and water were treated with an excess of sulphuric acid, filtered, and washed twice with water, the filtrate and each wash water being kept separate. A further quantity of rock powder was then added to the filtrate with sufficient acid to dissolve it. This was also filtered and washed twice, each liquor being kept separate. The process was repeated five times, after which it was found that the mother liquor contained from 25 to 30 per cent of phosphoric acid. The next portion of rock was stirred with the first wash water, and so on, until a solution sufficiently concentrated for further treatment was obtained without evaporation. The relative purity of the solution was not reduced by the successive extractions, tests having shown that the quantity of sesquioxides dissolved by sulphuric acid does not depend on the amount of acid used but on the actual concentration of the acid in the solution.

Tetraphosphate as a fertilizer, J. HUDIG and C. MELJER (*Dept. Landb., Nijv. en Handel [Netherlands], Verlag. Landbouwk. Onderzoek. Rijkslandbouw-proefsta.*, No. 25 (1921), pp. 140-159, pls. 8).—Experiments are reported which showed that tetraphosphate when used in sand cultures under alkaline conditions gave no better results for oats than ground raw phosphate, and was considerably behind soluble phosphates as a fertilizer.

In sand cultures under acid conditions tetraphosphate gave good results on crops, but these were no better than those given by ground raw phosphates and were about the same as those given by soluble phosphates. Out of experiments on 44 different fields, 31 showed tetraphosphate action. In nine of these cases the action was considerably better than that of the natural French phosphates, and about the same action was given as by superphosphate.

These results are taken to indicate the importance of tetraphosphate as a fertilizer, although it is stated that seldom can tetraphosphate displace super-

phosphate. The single case in which tetraphosphate gave better results than superphosphate occurred on very acid soil.

Greensand as a source of fertilizer potash, R. N. SHREVE (*Amer. Fert.*, 55 (1921), No. 14, pp. 35, 36).—Data are reported which indicate that greensand occurs very extensively in the eastern United States and particularly in New Jersey. It is shown that the caustic potash initially formed from the greensand is very advantageously changed into potassium nitrate and caustic soda. It is concluded that the potassium nitrate, containing two fertilizer ingredients, will result in a considerable saving in freight.

On the discovery of potash in west Texas, J. A. UDDEN (*Chem. and Metall. Engin.*, 25 (1921), No. 26, pp. 1179, 1180).—A brief comment is made on the nature and extent of the potash-bearing minerals discovered at considerable depths in certain localities of west Texas. The potash-bearing mineral is, in almost every case noted, a red salt which is now believed to be polyhalite, containing from 18 to 19 per cent of potash.

A summary of the evidence obtained on the existence of potash in the locality is taken to indicate the correctness of the conclusion that widespread beds of potash exist in the region. No information is yet available as to the thickness of the beds.

Lime report, 1920, J. W. KELLOGG (*Penn. Dept. Agr. Bul.* 353 (1921), pp. 33).—This bulletin contains the results of official analyses of 84 samples of limes and limestones, representing 40 different brands, collected for inspection in Pennsylvania during 1920.

The effect of gypsum on soil reaction, L. W. ERDMAN (*Soil Sci.*, 12 (1921), No. 6, pp. 433-448).—Laboratory experiments conducted at the Iowa Experiment Station are reported.

Gypsum added in amounts of from 100 to 2,000 lbs. per acre to an acid soil, a neutral soil, and a basic soil did not increase or correct the acidity of the soil as shown by the Tacke lime-requirement method. Gypsum applied at rates of 100, 200, and 500 lbs. per acre did not raise or lower the hydrogen-ion concentration of the soil as measured by the hydrogen electrode. Excessive amounts of 1,000 and 2,000 lbs. of gypsum per acre showed increases in acidity by the hydrogen electrode amounting to 0.21 pH and 0.28 pH, respectively, for the acid soil studied, 0.14 pH and 0.27 pH, respectively, for the neutral soil studied, and 0.09 pH and 0.12 pH, respectively, for the basic soil. Gypsum applied at the rate of 500 lbs. per acre to a neutral soil made to vary in degrees of acidity by additions of hydrochloric acid and calcium carbonate had no effect on the hydrogen-ion concentration of the soil, and did not show sufficient lime requirement by the Tacke method to permit of the conclusion that gypsum had any effect on acidity.

The influence of common salt on the growth, quality, and water utilization of sugar beets, M. HOFFMANN (*Bl. Zuckerrübenbau*, 28 (1921), No. 15-16, pp. 157-162).—Several sets of laboratory and field studies on the influence of common salt on the growth, quality, and water utilization of sugar beets as compared with results from pure sodium chlorid, Glauber salt, sodium nitrate, and calcium chlorid are reported.

Common salt and generally most sodium salts increased the quantity and quality of the sugar-beet crop on both light and heavy soils where only light potash applications had been made and heavy sodium fertilization was practiced. Glauber salt and sodium nitrate gave better results than calcium chlorid. This is taken to indicate that it is the sodium of the common salt and not the chlorin which favorably influences the growth of crops.

It was found that the use of sodium reduced evaporation and increased the water-holding power of the soil. It is also thought that through an exchange

of bases it is capable of rendering certain relatively insoluble nutritive salts more available to plants. When sodium salts were used, the sodium was found almost exclusively in the leaves of the plants, where it apparently displaced a certain amount of potash. An increase in the sugar content of beets also accompanied fertilization with sodium salts.

Sodium compounds in 1920, R. C. WELLS (*U. S. Geol. Survey, Min. Resources U. S.*, 1920, pt. 2, pp. 123-134).—Data on the sales, prices, imports, exports, and production of sodium salts in the United States for the year 1920 are presented. It is shown that during 1920, 2,961,038,080 lbs. of sodium nitrate were imported into the United States, while in 1919 the imports amounted to 912,932,160 lbs.

Carbonic acid as a fertilizer, FRENKEL (*Ann. Chim. Analyt.*, 2. ser., 3 (1921), No. 7, pp. 201-205).—Experiments are reported in which it was found that plants growing in a glass chamber absorbed carbon dioxide rapidly. After 30 minutes the amount of carbon dioxide in the atmosphere decreased from 5.2 to 2 parts per thousand, and after 50 minutes more to 0.26 part per thousand. An atmosphere containing a large proportion of carbon dioxide was found to increase the growth of potatoes and lupines nearly 200 per cent, and beets, spinach, and barley showed respective increases of 15, 60, and 100 per cent.

Fertilizer experiments with müll, O. HEUSER (*Mitt. Ver. Förd. Moorkult. Deut. Reiche*, 39 (1921), No. 21, pp. 383-385).—Müll is a composted domestic waste composed of ashes, garbage, and other trash, except permanently hard objects such as bottles, bricks, and stones. The müll is dumped in large heaps and composted for as long as eight years. After such a period it becomes a reddish-brown crumbly to powdery mass having the following average chemical composition: Nitrogen 0.278, potash 0.332, lime 12.06, water-soluble potash 0.242, citrate-soluble phosphoric acid 0.189, and organic matter 4.98 per cent. The reaction is weakly alkaline.

Experiments with müll on a well-decomposed lowland moor soil rich in nitrogen, growing hemp and potatoes, showed that the müll caused a distinct increase in yield. This was more evident in the case of hemp than in the case of potatoes.

AGRICULTURAL BOTANY.

Fundamentals of plant culture and fish culture, H. FISCHER (*Naturwissenschaftliche Grundlagen des Pflanzenbaues und der Teichwirtschaft. Stuttgart: Eugen Ulmer*, 1920, pp. XII+211, figs. 21).—This little book deals principally with climate, soil, and plant in their interrelationships as bearing upon the questions of organic production, and is intended for use in agriculture, forestry, and pisciculture, also in physiological and biological study. The list which is given of related literature includes contributions by about 70 authors.

Influence of climatic factors on the distribution of epiphytes on tree trunks in Java, P. VAN OYE (*Rev. Gén. Bot.*, 33 (1921), No. 387, pp. 161-176, figs. 15).—A study detailed as made in the Dutch East Indies shows that the distribution of epiphytes on tree trunks there is due chiefly to the climatic factors, illumination and moisture.

Thermal conditions in the soil under the influence of local vegetation, E. and A. GAIN (*Rev. Gén. Bot.*, 32 (1920), No. 376, pp. 161-164).—Observations noted are considered to show that vegetation may, by influencing unequally insolation and evaporation, determine differences in biological reactions in the soil, producing results of agricultural importance.

Production of a new daffodil by the action of marine climate, L. DANIEL (*Rev. Gén. Bot.*, 33 (1921), Nos. 388, pp. 225-237, pls. 3, figs. 3; 389, pp. 316-327, figs. 8; 390, pp. 357-371, figs. 3; 391, pp. 420-436, fig. 1).—An account is given

of the determination in *Asphodelus luteus*, under the influence of a marine climate, of progressive modification of this species, resulting in a form regarded by experienced botanists as a new species, very distinct as to morphological and physiological characters and accordingly named *A. luteoides*. This is regarded as the first authentic example of so clear a differentiation under the influence of marine climate, which factor is thought to have acted alone to produce the permanent changes here noted.

Bud variations in trees and shrubs as a cause of decadence in varieties, A. CHEVALIER (*Compt. Rend. Acad. Sci. [Paris]*, 171 (1920), No. 21, pp. 1011-1014).—The author claims to show that bud variation is a cause of decadence in improved varieties of plants propagated for a long period asexually.

The influence of senescence of germinal cells on the numerical relations of segregating hybrids, C. CORRENS (*Naturwissenschaften*, 9 (1921), No. 18, pp. 313-315).—Age of pollen appears to make some difference in the ratios of the descendants produced by the crossing of *Hyoscyamus niger medius* and *H. niger pallidus*.

Interspecific hybrids in *Crepis*.—I, *Crepis capillaris* × *C. tectorum*, E. B. BABCOCK and J. L. COLLINS (*Natl. Acad. Sci. Proc.*, 6 (1920), No. 11, pp. 670-673).—This is a more condensed account than that of the same or closely related work previously noted (E. S. R., 46, p. 223).

The unusual behavior noted in the hybrids (all of which failed to pass the cotyledon stage) may be due to what is characterized as a most unusual teratological condition of the tissue systems and of the cells. These were in a chaotic condition where order and continuity should be expected. In order to obtain further information on certain phases of the problems involved, trial crosses were begun with 36 species of *Crepis* to test their chromosome relationships.

The Linnaean concept of pearl millet, A. CHASE (*Amer. Jour. Bot.*, 8 (1921), No. 1, pp. 41-49).—The author presents the results of an analysis of the Linnaean terms involved in the naming of pearl millet, discussing the apparent causes of the lack of correspondence or of precision observed.

The identification of *Berberis aquifolium* and *B. repens*, C. V. PIPER (*U. S. Natl. Mus., Contrib. U. S. Natl. Herbarium*, 20 (1922), pt. 11, pp. VII+437-451, pls. 3).—The author presents evidence regarding the identification of two northwestern species of *Berberis*.

New plants from Guatemala and Honduras, S. F. BLAKE (*U. S. Natl. Mus., Contrib. U. S. Natl. Herbarium*, 24 (1922), pt. 1, pp. X+32, pls. 10, figs. 4).—A description is given of a number of new species of flowering plants collected by an economic survey mission to Guatemala and Honduras.

The modification of vegetative and reproductive functions under some varying conditions of metabolism, E. J. KRAUS (*Amer. Jour. Bot.*, 7 (1920), No. 10, pp. 409-416).—Outlining the various observations and data relied upon in both the past and the present to support conclusions regarding the modifiability of vegetative and of reproductive plant characters by different foods and conditions, the author indicates the inevitable complications and the need for further investigations.

Seasonal rhythm and soil awakening, A. LUMIÈRE (*Rev. Gén. Bot.*, 33 (1921), No. 393, pp. 545-557, figs. 8).—The author questions the conclusions offered by Müntz and Gaudechon (E. S. R., 26, p. 722), holding that the so-called awakening of the soil in the spring is due largely to the removal of growth-inhibiting substances by percolating water or its neutralization by oxygen under conditions favoring the entrance of these substances. Further studies have been started to test this theory and to throw light upon its probable importance in connection with culture, germination, and fertility studies.

The plant as a symbiotic complex, C. DE MÉRÉJKOVSKY (*Bul. Soc. Sci. Nat. Ouest France*, 3. ser., 6 (1920), No. 1, pp. 17-98, figs. 9).—This discussion deals with the continuity of chromatophores, structure in the Cyanophyceae, morphological and physiological identities and analogies, phylogeny, independence of the nucleus, chromatophores in Diatomaceae, secondary evidences, plastids, and mitochondria. It is considered definitely established that a plant presents essentially a case of double symbiosis, and an attempt is made to show the desirability of considering it from this standpoint.

Influence of reserve material (endosperm) of seeds on the development of the embryo, A. URBAIN (*Rev. Gén. Bot.*, 32 (1920), Nos. 375, pp. 125-139, figs. 8; 376, pp. 165-191, figs. 16).—The first chapter of this report deals with the influence of the endosperm in the development of the embryo. The second part notes a morphological study, both internal and external, of adult plants experimentally produced from embryos deprived of endosperm.

Germinability of new seeds, DENAÏFFE and COLLE (*Jour. Agr. Prat.*, n. ser., 36 (1921), No. 28, pp. 56-58).—Factors influencing percentage of germination of seeds as here dealt with include degree of dryness, impermeability, and maturity.

Morphology and life history of some Ascomycetes, with special reference to the presence and function of spermatia, B. B. HIGGINS (*Amer. Jour. Bot.*, 7 (1920), No. 10, pp. 435-444, pl. 1, figs. 2).—This refers chiefly to the production of conidia, spermatia, perithecia, and spermogonia by a fungus on *Ficus carica*, which is described as a new species under the name *Mycosphaerella bolleana*.

Recent observations regarding the origin of plastids in phanerogams, A. GUILLIERMOND (*Rev. Gén. Bot.*, 33 (1921), Nos. 391, pp. 401-419, pls. 13, figs. 5; 392, pp. 449-470, figs. 3).—Studies are detailed as carried out on plastids in roots of cucurbit, castor oil plant, bean, pea, and maize, and in various portions of other plants. The origin of plastids is discussed in relation with mitochondrial and other bodies. A bibliography is appended.

The rôle of celluloses in plant life, R. W. THATCHER (*Abs. in Science*, n. ser., 55 (1922), No. 1412, p. 80).—According to their chemical composition, celluloses are classified into three groups, hemicelluloses, normal celluloses, and compound celluloses. Hemicelluloses are said to be amorphous polysaccharids, which are probably reserve carbohydrates deposited in the structural or cell-wall materials rather than in storage organs. Normal celluloses are amorphous forms of polysaccharids having an empirical formula similar to that of starch, but exhibiting a fibrous structure instead of the granular structure characteristic of starch. They are said to be true cell-wall, structural material that can be hydrolized by certain bacteria, but probably have no nutritive function in higher plants. The compound celluloses are said to be either colloidal complexes or definite chemical compounds of true cellulose with some encrusting material which serves to stiffen and harden the cellular structure and convert it into wood. They are believed to be among the most inert plant compounds, and probably have no rôle other than that of adding strength and stiffness to the stems or other tissues of plants.

Prussic acid in juar, [S. MILLIGAN] (*India [Dept. Agr.] Rev. Operations*, 1919-20, pp. 46, 47).—The conditions which favor the formation of prussic acid in *Andropogon sorghum* were studied in the laboratory of the agricultural chemist, Bihar and Orissa. The records indicate that the humidity of the atmosphere has a much greater effect than soil moisture upon the formation of this acid, that dried juar kept for some time (also the plant in a dying condition) shows no trace of prussic acid, and that plants grown in the shade contain a slightly higher percentage of the acid than do those grown in the sun.

The fixation of free nitrogen by green plants, F. B. WANN (*Amer. Jour. Bot.*, 8 (1921), No. 1, pp. 1-29, pl. 1, fig. 1).—The author states that but little of significance has been added recently to the literature as formerly reviewed by Schramm (*E. S. R.*, 31, p. 827) regarding the relation of grass-green algae to free nitrogen. Though it has come to be very generally accepted, as the result of studies here cited, that the Chlorophyceae and the higher plants are not able to utilize free nitrogen, the number of species investigated in pure culture is regarded as insufficient, and the culture methods inadequate in some instances. Accordingly, he has undertaken experimentation for the purpose of extending the observations over a larger number of species, grown on a variety of mineral nutrient solutions under culture conditions insuring rapid and vigorous growth.

It is stated that seven species of grass-green algae exhibited ability to fix nitrogen when grown in pure cultures on mineral nutrient agar media containing glucose, and with either ammonium nitrate or calcium nitrate as a source of nitrogen. The nitrogen fixed was derived from the free nitrogen of the atmosphere. The amounts of fixation ranged from 1 to 12.5 mg., representing increases in the total nitrogen content of the culture flasks of from 4 to 54 per cent. Five of the above-mentioned species were grown on ammonium nitrate and calcium nitrate without glucose. Four of these showed slight growth but a slight increase in nitrogen. Neither in the presence nor in the absence of glucose or of mannite did fixation occur when urea, glycocoll, asparagin, or ammonium sulphate was supplied as a nitrogen source.

One species exhibited what appears to be a denitrification on media containing either ammonium nitrate or calcium nitrate as nitrogen sources, both in the absence of an organic carbon source and in the presence of mannite, the loss in nitrogen being from 2.2 to 8.3 mg. per 100 gm. of culture medium.

Comparative utilization of constituents by *Xylaria hypoxylon*, C.-L. GATIN and M. MOLLIARD (*Rev. Gén. Bot.*, 32 (1920), No. 377, pp. 216-225).—Collaboration in this work, a preliminary account of which has been reported (*E. S. R.*, 24, p. 431), having been terminated by the death of Gatin, the surviving author submits the data so far as obtained.

Metachromatin and tannic compounds in vacuoles, P. DANGEARD (*Compt. Rend. Acad. Sci. [Paris]*, 171 (1920), No. 21, pp. 1016-1019, fig. 1).—A further account is given of changes in tanniferous vacuoles as referred to in a previous note (*E. S. R.*, 45, p. 30).

It is stated that the young vacuomes contain metachromatin to which is due their vital coloration. They have the appearance of chondriomes, but are distinguishable therefrom by their mode of development and by their evident connection throughout their transformations with the vacuolar system. Impregnation with tannin is only one of the more important of their modifications.

Variation of organic acids during anthocyanin pigmentation, D. KOHLER (*Rev. Gén. Bot.*, 33 (1921), Nos. 389, pp. 295-315, fig. 1; 390, pp. 337-356).—In corollas of *Cobaea scandens* and in leaves of *Ampelopsis tricuspidata* the formation of anthocyanin was found to be correlated with augmentation in organic acid content. In buckwheat the formation of anthocyanin was accompanied by a decrease of organic acid. Detailed consideration is given to the cases of coloration of organs after their separation from the plant, and to the probable bearings of these facts.

The synthesis of full coloration in phlox, J. P. KELLY (*Science*, n. ser., 55 (1922), No. 1418, p. 245).—In a previous publication (*E. S. R.*, 44, p. 428), the author described some of the facts pertaining to the inheritance of flower color in *Phlox drummondii*. Certain F₁ purples when self-pollinated have been found to give rise to several different types, among them a showy full-colored purple

or rose type, a lighter type whose color is bright pinkish or light purplish, a dusky type of dull magenta color stippled onto the blade giving the flower the appearance of a dusty or dirty looking white, and a pure white type.

The first type has been found to give rise to the second and third types, but the second type never gave rise to dusky-colored flowers, nor the plants bearing the dusky-colored flowers to the lighter type indicated above. By combining the second and third types, type 1, a showy full-colored purple or rose color, was produced. These facts are believed to indicate that full or deep coloration in phlox is due to the presence together of the second and third types, or rather to the genes for these two types, which are not allelomorphic.

New color reactions utilizable in the diagnosis of mycological species, J. BARLOT (*Compt. Rend. Acad. Sci. [Paris]*, 171 (1920), No. 21, pp. 1014-1016).—The color reactions given by certain fungi, which are named, in connection with certain colorants are here designated on the plan indicated by Klincksieck and Vallette (*E. S. R.*, 22, p. 662).

Observations on algae cultivated in darkness for eight years, P. A. DAN-GEARD (*Compt. Rend. Acad. Sci. [Paris]*, 172 (1921), No. 5, pp. 254-260, figs. 26).—In the favorable medium here described, the alga *Scenedesmus acutus* has lived since January, 1913, and formed chlorophyll continuously without access of light. An account is given of the cell contents and of changes therein.

Unlike interpretations of Fuller's scale in determining degree of acidity, H. R. ROSEN (*Science, n. ser.*, 55 (1922), No. 1412, pp. 76, 77).—Attention is called to the different interpretations given by animal pathologists and bacteriologists and plant pathologists of Fuller's scale used in the preparation of culture media, and to the desirability that authors state in their publications their interpretation of the scale when describing the acidity of media.

FIELD CROPS.

Investigations in dry-land agriculture [at the Huntley, Mont., Reclamation Project Experiment Farm], A. E. SEAMANS (*U. S. Dept. Agr., Dept. Circ. 204* (1921), pp. 12-17).—The yields from small grain in 1920 (*E. S. R.*, 46, p. 327) and work with corn (*E. S. R.*, 45, p. 534) have been noted. The average acre yields of cereals over a period of years on summer fallow, on disked corn land, and after peas, rye, or sweet clover plowed under for green manure, respectively, were as follows: Winter wheat (6 years) 28.4, 17.2, and 22.8 bu.; spring wheat (7 years) 21.8, 16.6, and 19.9 bu.; oats (7 years) 49.2, 36.9, and 44.2 bu.; and barley (5 years) 24.9, 19.8, and 27.5 bu. Increases by fall plowing over spring plowing averaged 1.5 bu. with spring wheat, 1.9 bu. with oats, and 0.8 bu. with barley. With the exception of flax on fallow, which averaged 12.4 bu., the several treatments with this crop were not characterized by considerable variation from the 7-year mean in all dry-land plats, 8.7 bu.

Alfalfa in a rotation after grain for 2 and 3 years produced during the period 1912 to 1919, inclusive, an average of 1,214 lbs. of hay per acre for the 2-year-old fields and 1,367 lbs. for the 3-year-old fields. Brome grass in a meadow rotation after grain gave 7-year averages of 523, 738, and 493 lbs. of hay per acre on 1-, 2-, and 3-year-old plats, respectively.

[**Field crops work on the Huntley, Mont., Reclamation Project Experiment Farm in 1920**], D. HANSEN (*U. S. Dept. Agr., Dept. Circ. 204* (1921), pp. 9-12, fig. 1).—Experiments with field crops are reported in continuation of earlier work (*E. S. R.*, 44, p. 732).

The maximum yields in the crop rotation experiments under irrigation were usually shown in the rotations including alfalfa or manure, while the least returns were given under continuous cropping or in the shorter rotations.

Potatoes following oats, manured, produced an average acre yield of 224.6 bu.; after oats, unmanured, 151.2 bu.; after alfalfa, 144.1 bu.; following sugar beets, 115.5 bu.; and cropped continuously, 100.3 bu. Oats produced their highest yields in rotations where oats followed a cultivated crop and in which either alfalfa or manure or both were included. The highest yield of sugar beets, 10.83 tons, occurred in a six-year rotation of three years of alfalfa, followed by corn, flax, and beets.

Results to date recommend Northwestern Dent corn for both silage and grain. Although Mammoth Black Russian sunflowers gave from 24 to 35 tons per acre during the years 1917 to 1920, inclusive, the silage made from this crop was not of good quality and was not relished by stock, contrary to results obtained in other parts of the State. An investigation of the failure to secure good sunflower silage at this station has been noted (E. S. R., 45, p. 871).

[Report of field crops work in South Carolina] (*South Carolina Sta. Rpt. 1921*, pp. 6-8, 9, 44, 46, 47, fig. 1).—Seed corn from productive stalks which had been fertilized with pollen from barren stalks produced fruitful and barren stalks in the proportion of 1:2.34. In the previous year a ratio of 1:3.38 was secured similarly. Varieties of field crops outstanding in tests at this station included Wannamaker-Cleveland cotton, Deltatype Webber, a long-staple variety, Douthit corn, Alabama Bluestem wheat, and Bancroft oats.

Phosphoric acid alone did not increase the yield of Irish potatoes at the Coast Substation, whereas with the further addition of potash an increase of 22 bu. per acre occurred. The highest yield was obtained from a complete fertilizer in which the nitrogen was in the form of equivalent amounts of blood, nitrate of soda, and cottonseed meal. As sources of nitrogen, blood, nitrate of soda, and cottonseed meal were effective in the order named.

The results of variety trials at the Pee Dee Substation are said to coincide with those at the station, indicating that the soil was not an important factor in causing variety superiority within the same crop. Applying all the potash in the fertilizer 30 days after planting cotton gave maximum yields of 1,530 lbs. of seed cotton per acre, and application of the potash before planting followed in effectiveness with 1,380 lbs. Breeding work with cotton, corn, sweet potatoes, and peanuts in cooperation with the U. S. Department of Agriculture is also noted.

[Report of agronomic work at the Guam Station, 1920], G. BRIGGS (*Guam Sta. Rpt. 1920*, pp. 16-34, 35-39, 40-44, pls. 2, figs. 2).—Experiments with field crops are reported along the same general lines as heretofore (E. S. R., 45, p. 33).

Detailed information concerning tests with Para and Paspalum grasses has been noted (E. S. R., 46, p. 440). The cost per acre of planting Para grass was as follows: Broadcasting the stalks, \$3; planting the stalks in furrows 3 ft. apart, \$3.60; planting stalks 30 to 36 in. each way, \$7.20; planting the roots 30 to 36 in. each way, \$9.80; and planting roots 3 to 5 ft. apart in furrows, \$10. Paspalum cost from \$15 to \$50 an acre, according to location and labor required to clear and prepare the land. Tests indicated that Para pastures grown by planting stalk cuttings will stand much more grazing than pastures started by strewing the ground with the cuttings. Johnson grass is said to be a greater pest in Guam than in the southern United States, because of the lack of cold weather to check its growth. Notes are included on Guinea grass, Guatemala grass, Sudan grass, and Japanese cane.

Yellow milo with 33.8 tons and white milo with 23.1 tons gave the highest yields of green forage of the grain sorghums on newly broken land, while feterita with 42.9 bu. and Dwarf hegari with 40.5 bu. led in grain yields. On old land, Dwarf hegari with 101.3 bu. gave twice as much grain as feterita, the next

highest, and also produced the most forage, 20 tons. Broom corn on new ground yielded 37.8 bu. of seed and 8.5 tons of green fodder with a very poor quality of brush. The Amber varieties gave the best results in all tests with sweet sorghums and seem well adapted to local conditions.

Cowpeas, velvet beans, and jack beans were successfully grown in the citrus orchard as cover crops. The velvet bean is considered the most efficient, but in the orchard or plantation it must be cut back or it will climb the trees. The dense growth of patani bean vines kept down the underbrush, grass, and weeds most satisfactorily in a coconut plantation. New Era cowpea gave the highest yield of seed and Brabham the highest forage yield. Yokohama, a medium maturing variety, made the highest production of seed in tests of velvet beans. Notes are given on pigeon peas, patani beans, peanuts, mungo beans, and bur clover, and variety tests of small beans, native beans, and soy beans are described.

Root crops tested and described include taro, cassava, arrowroot, edible canna, and sweet potatoes. Acre yields obtained amounted to 3,315 lbs. with Pacencia taro, 4,162 to 15,631 lbs. with cassava, 3,123 with arrowroot, 1,025 lbs. with canna, and 61.7 bu. with Amarillo sweet potatoes.

Cleveland and Express led the cotton varieties tested.

Corn tests dealing with rates of planting, varieties, and breeding work were conducted during the year. Plantings at rates of 2 and 3 stalks per hill gave 58 and 54.1 bu., respectively, per acre, while yields ranging from 30.4 to 33.2 bu. were secured from 1, 4, 5, and 6 stalk rates. Measurements of stalks of corn selected through 10 generations for early maturity, uniformity to type, and one ear per stalk, and data from stalks from unselected seed throughout the island, respectively, showed averages of 6 and 7.6 ft. for height of stalk, with ears 2.5 and 3.8 ft. above ground and weighing 0.5 and 0.33 lb., of 6.5 and 7.4 nodes below the ear, and of 5.1 and 4.8 nodes above the ear. Apparently, the decrease in height of ear from ground is not due so much to a decrease in the length of internodes or a less number of nodes as it is to change of position of the ears upon the stalks. The size of ear and cob of the selected corn has decreased materially.

Applications of nitrogen with acid phosphate generally resulted beneficially in fertilizer tests with rice. Earlier data were confirmed, apparently indicating that sodium nitrate applied alone is more beneficial than in combination, but that ammonium sulphate gives much larger returns when applied combined with other fertilizers. The rice receiving ammonium sulphate and acid phosphate matured from 3 to 6 days earlier than the other plats. Variety tests are also briefly noted.

[Report of field crops work in Northumberland County, England], D. A. GILCHRIST (*County Northumb. Ed. Com. Bul. 33 (1921), pp. 30-38, 44-86, pl. 1*).—The continuation of rotation, fertilizer, and variety trials with various field crops is reported as heretofore (E. S. R., 44, p. 433).

In comparisons of fertilizers for meadow hay on a stiff boulder clay soil from 1897 to 1920, inclusive, the annual application of 8 tons of dung has produced the most profitable returns and the second highest yield. Sulphate of ammonia, either alone or in combination with other minerals, did not give a profitable increase. Phosphates in the form of basic slag were the most profitable of the artificial fertilizers. The results of feeding trials indicate that dung with complete artificials, as well as nitrogenous fertilizers, considerably reduces the quality of the hay; that dung alone is rather beneficial; and that phosphates, especially with the addition of potash, cause a great improvement in the quality. Considering both weight and quality of hay, the best results

were given by dung alone, slag alone, and slag with muriate of potash in the order named.

Properly cutting the weeds or mowing hay early and close to the ground removes practically all thistles in pastures. While salt dressings checked yellow rattle very slightly and seriously injured grasses and clovers, moving before seed formation completely eliminated the weed.

[**Report of field crops work in British Guiana**], J. B. HARRISON (*Brit. Guiana Dept. Sci. and Agr. Rpt. 1919, pp. 4-32*).—The progress of experiments with sugar cane and rice is described for the period ended with July, 1920, and supplementing earlier work (E. S. R., 45, p. 33).

The principal varieties of sugar cane in the 1920 crops with their percentages of the total area include D 625, 50.9 per cent; D 145, 7.3; D 118, 5.1; B 208, 4.3; and Bourbon, 4.1 per cent. In a series of trials from plant cane to second ratoons, D 367, D 118, D 248, and D 181 were outstanding with respective average acre yields per crop of 26, 22.3, 24.2, and 22.1 tons of cane and with 2.92, 2.6, 2.55, and 2.32 tons of indicated sugar. While Green Transparent (Salangor) gave 3.69 tons of indicated sugar as plant cane, the first ratoon yield fell to 1.41 tons and the second ratoon to 0.38 ton, demonstrating the unreliability of the variety.

The average acre yields from plant cane to second ratoons in the rice-straw mulch series were D 625, 22.7 tons; D 118, 17.4 tons; and D 145, 17.4 tons, with 2.47, 2.17, and 1.78 tons of indicated sugar. When these varieties received dressings of 200, 300, 400, and 500 lbs. of sulphate of ammonia and 375 lbs. of nitrate of soda, increases over the unfertilized check during the three crops averaged 3, 7.4, 11.4, 11.7, and 4.5 tons of cane, respectively. Rice straw applied at the rate of 25,000 lbs. per acre resulted in an average yield of 20.8 tons as compared with 17.4 tons from unmulched cane. Average increases per crop due to the use of rice straw on the three crops amounted to 2.5 tons without fertilizer, 4.3 with potash alone, 2.5 with sulphate of ammonia alone, 3.8 with potash and 250 lbs. of sulphate of ammonia, 3.3 with potash and 450 lbs. of sulphate of ammonia, and 4.3 with potash and nitrate of soda.

[**Field crops work of the Agricultural Research Institute, Pusa, 1919-1921**], G. P. HECTOR and A. and G. L. C. HOWARD (*Agr. Research Inst. Pusa, Sci. Rpts., 1919-20, pp. 46-55; 1920-21, pp. 8-17, pl. 1*).—These pages describe the continuation of work noted previously (E. S. R., 44, p. 633).

Grassland, R. G. STAPLEDON (*Oxford: Univ. Press, 1921, p. 19*).—In this paper the author compares permanent with temporary grass and mixtures with single species, and discusses improved herbage plants, rotations with grass as a pivotal crop, and the management of temporary grass.

Work with herbage plants at Aberystwyth, Wales, has shown the incompatibility of certain species for growth together—rye grass and cocksfoot (orchard grass), tall oat grass and cocksfoot, and late-flowering red clover and alsike clover being examples of this tendency. Different species compared in pure plats exhibited different growing periods, and it was noted that stock chose one species at one date and another at some other time. In March and April sheep grazed tall oat grass in preference to nearly all other grasses, while Italian rye grass and cocksfoot were preferred to perennial rye grass in April. The influence of a previous year's management on early spring productivity was demonstrated where beds of cocksfoot cut once during 1920 returned over twice as much green material during February and April, 1921, as beds cut once in 1920 for hay (June) and 7 times afterwards, and four times as much as beds cut once for hay (May) and cut 10 times afterwards.

Indigenous forage plants proved far more leafy and produced more tillers than plants from imported seed. The average number of tillers produced by

plants more than one year old was as follows: Red clover, Montgomery 150, Cornish Marl 125, Canadian 68, English late-flowering 50, Chilean 30, and Italian 27; timothy, native 160, commercial 70; tall oat grass, native 130, commercial 80; and cocksfoot, native 95, commercial 60. Hay from native, American, Danish, and French cocksfoot contained 38, 24, 25, and 23 per cent of leaves, respectively. The indigenous forms of all the species, except red clover, have a general tendency to flower later than the imported, some of the wild cocksfoot flowering from 10 to 20 days later.

[**Alfalfa breeding in Sweden**], H. WITTE (*Sveriges Utsädesför. Tidskr.*, 31 (1921), No. 5, pp. 185-200).—The possibilities and purposes of alfalfa breeding in Sweden are discussed, and the results of a study of different characters in the cross between blue-flowered alfalfa (*Medicago sativa*) and yellow-flowered alfalfa (*M. falcata*) are reported. The more important field tests in different countries to determine the value of alfalfa from different sources are reviewed. It is reported that alfalfa grown from Hungarian seed is best adapted to middle and southern Sweden, the sections of the country to which successful alfalfa culture is limited, but the variegated alfalfa, or the hybrid between the blue-flowered and yellow-flowered types, is also proving of promise and may be of value where common alfalfa is not sufficiently hardy.

While common alfalfa is not grown for seed in Sweden, it was observed in connection with alfalfa improvement work in progress at Svalöf for several years that in the F_1 generation of the cross above mentioned plants of a high seed yielding capacity were produced. It is stated that the two species cross readily, and that even without the removal of the stamens cross-pollination results in a higher percentage of hybrids than of individuals arising from self-fertilization.

A study of the F_1 and F_2 generations showed the F_1 to be nearly intermediate, having a more spreading growth and more branched shoots than *M. sativa*, but not being so decumbent as *M. falcata*. The blossom color of the F_1 was an indistinct or greenish yellow, with more or less marked greenish violet nerves. The pods were distinctly intermediate in their characters, and the stooling power was not so pronounced as in *M. falcata*, but in greater evidence than in *M. sativa*. The aftergrowth of the hybrid was found to be light, but slightly better than that of *M. falcata*, and the seed production appeared to be much better than that of either parent.

The F_2 generation was marked by extensive and complex segregation. In some of the plants the stems were longer, in others shorter, than in the parents, and while the plants in general were of a spreading type as in the F_1 , individuals with nearly upright stems and others nearly decumbent in form occurred. Most of the blossoms were of the color of those in the F_1 generation, but other colors, such as white, light yellow, brownish violet, violet-blue, and numerous shades of these appeared. The pods likewise were in general like those in the F_1 , but individuals with pods of the blue-flowered or the yellow-flowered type were also observed. The seed setting of the F_2 plants was relatively poor, some plants producing no seeds at all, while in some seed production was quite marked. One individual plant produced the first year 39.8 gm. of seed, or one-eighth the weight of its hay yield. The aftergrowth of the F_2 plants was generally very small.

An improved method of lucern cultivation in Bihar, A. and G. L. C. HOWARD (*Agr. Research Inst. Pusa, Sci. Rpts.*, 1920-21, p. 18, pl. 1).—Among the difficulties met in growing alfalfa in North Bihar are the preservation of the crop during the rains and the reduction of the volume of irrigation water needed subsequently. During the monsoon, alfalfa ordinarily dies out from wilt as a result of poor soil aeration following consolidation of the surface soil.

The authors found it possible to preserve the alfalfa crop and to carry it through two seasons successfully by growing it on flat beds 3 ft. wide separated by irrigation furrows 1 ft. in width. The furrows act as local drains during the rains and improve the soil aeration so that the stand survives. The method is also used for the production of seed of sanal, patwa, and Java indigo.

The effect of fertilizers on the yield and quality of barley varieties, J. AHR and C. MAYR (*Untersuchung über Düngungseinflüsse auf Ertrag und Güte bei Verschiedenen Neuzüchtungen von Gerstensorten*, Freising: F. P. Datterer & Co., 1919, pp. 123, pls. 6, fig. 1).—Barley varieties including three Welhenstephan selections, Fg II and Fg III, both upper Bavarian strains, and Ng IV, a lower Bavarian strain; two Ackerman selections designated as Danubia and Bavaria; and a Franconian barley (HI) were planted in pots containing diluvial loam soil, low in humus, and received fertilizer treatments of nitrogen, phosphorus, potassium, and calcium alone, applications omitting one of each of the first three elements, and complete fertilizers with and without calcium.

The grain yields and dry matter production showed Fg II and Fg III to possess the largest and Ng IV the smallest lime requirements. Danubia was most sensitive to the use of nitrogen alone and was followed by Bavaria and HI, with Fg II affected very slightly. Varietal differences were not so obvious in the reactions to phosphorus and potassium alone.

In the average of all fertilizer treatments, the grain of HI was highest in quality, i. e., with light starch and low protein content, and that of Ng IV was lowest. Calcium alone, like phosphorus alone, favored quality, with HI and Danubia affected most in this respect and Ng IV the least. Potassium, alone and with phosphorus, depressed the protein content, and nitrogen alone adversely affected quality, most in Danubia and HI, and least in Ng IV. The protein content of large and small kernels was approximately equal in Danubia, slightly higher in the smaller kernels of HI, and lower in the smaller kernels of the other varieties. Throughout the experiments, the authors noted striking tendencies of climatic and growth conditions to mask varietal differences.

Home-grown and imported red clover seed, R. G. WIGGANS (*Jour. Amer. Soc. Agron.*, 13 (1921), No. 8, pp. 334, 335).—Results of tests at the New York Cornell Station indicate that red clover from Italian seed winterkills easily under New York conditions, and that the use of French seed is considered of doubtful advisability if native-grown seed can be obtained.

Correlation between the yields and prolificness of corn varieties grown in Mississippi, H. B. BROWN and J. F. O'KELLY (*Mississippi Sta. Circ.* 40 (1921), pp. 4, figs. 2).—The majority of the leaders in variety tests with corn conducted by the station during the past 11 years were prolific, and varieties of this type were indicated as outstanding in tests at other southern stations. In trials at the station in 1920 and 1921, the coefficients of correlation between yields and prolificness were 0.534 ± 0.1074 and 0.6436 ± 0.0884 , respectively.

Official report of the World Cotton Conference, 1921 (*Manchester, Eng.: World Cotton Conf. Exec. Com.*, 1921, pp. 99–290, figs. 17).—This comprises the official report of the proceedings of the World Cotton Conference held at Liverpool, June 13–15, and Manchester, June 16–22, 1921. Among the papers presented were the following: How Can the Quality of the American Cotton Crop be Improved and the Supply Kept Adequate to the Demand? by D. R. Coker; The Exploration and Development of New Cotton Fields Within the British Empire, by W. H. Himbury; Universal Standards for American Cotton, by W. R. Meadows; The Problems of Financing American Cotton, by W. H. Booth; Financing Cotton Imports, by J. H. Simpson; Characteristics of Cotton Required by the Spinner and Present Defects in the Raw Material, by W. Howarth; The

Scope of a Research Institute for the Cotton Industry, by A. W. Crossley; Cotton Statistics and the International Institute of Agriculture, by U. Ricci; The Possibilities with Cotton Crops for Exact Reporting and Forecasting, by W. L. Balls; Transportation of Cotton, by A. Watson; and Needed Reforms in the Ginning, Baling, and Compressing of Cotton, by A. L. Scott and F. S. Blanchard. Appended tabulated statistics show the production, composition, distribution, commercial movement, consumption, and prices of the cotton crops of the world, the United States, India, and Egypt.

Report of the synonym committee on the potatoes sent for immunity trials to the potato testing station, Ormskirk, Lancashire, 1920, R. N. SALAMAN ET AL. (*Natl. Inst. Agr. Bot., Potato Synonym Com. Rpt. 1920, pp. 3-16*).—The committee regards "two potatoes as synonymous not only when they present precisely similar morphological characters as regards the flower, foliage, habit of growth, color of stem, stolon formation, size, shape, and color of tuber, but also when the two varieties possess identical physiological characteristics as exhibited by identity of maturity and resistance or susceptibility to wart disease." This does not necessarily imply absolutely identical origin.

The synonymous varieties fell into one class comprising present commercial types such as Up-to-date, Abundance, Great Scot, and King Edward, and into a second class comprising older and more obscure varieties, such as Cardinal, Early Rose, and Nonesuch, no longer found in markets, "but which linger on in the backwaters of the countryside." Of the 242 varieties examined, 41 were identical with Up-to-date, 20 with Abundance, 17 with British Queen, and 14 with King Edward. More than one representative of each type of the second class was seldom found. The varieties were classified into 42 groups, which are tabulated with the origins, brief descriptions, and wart immunity.

Proposed identification key of cane varieties in the Philippines, N. B. MENDIOLA (*Sugar Cent. and Planters News, 3 (1922), No. 1, pp. 16-18*).—A tentative key.

The windrowing of sugar cane (*Agr. Research Inst. Pusa, Sci. Rpts., (1919-20, p. 39; 1920-21, pp. 23, 24)*).—In continuing at Pusa experiments on the windrowing of sugar cane (*E. S. R., 45, p. 343*), small samples of cane with the cut ends paraffined were stored in desiccators, and later examination disclosed a slight increase in sucrose. Wetting the samples after desiccation produced a decline in sucrose content similar to that noted in the field at Peshawar. Further research indicated the close connection of internal enzymic activities with the transformation of sucrose. In studying the enzym, P. B. Sanyal found the usual thymol solution to be of insufficient toxicity to suppress bacterial activity, but that thymolated alcohol was more effective in certain cases.

How the farmer can save his sweet potatoes, and ways of preparing for the table, G. W. CARVER (*Alabama Tuskegee Sta. Bul. 38 (1922), pp. 5-23, fig. 4*).—Cultural, field, and harvesting practices involved in the production of sweet potatoes are briefly outlined, with notes on disease control, curing, canning, and storage. In addition to 31 recipes for utilizing sweet potatoes, the results of limited feeding trials with mules and hogs are briefly noted.

[Experiments with winter wheat varieties in Sweden, 1914-1921], I. WÄLSTEDT (*Sveriges Utsädesförs. Tidskr., 31 (1921), No. 5, pp. 201-207*).—The results of tests with winter wheat varieties, including many improved sorts, conducted by the Swedish Seed Association in several localities in Östergötland with varying soil conditions are summarized. The number of test plats ranged from 36 in 1914 to 612 in 1920. The data reported are based on the varieties under test at least 4 years. The performance of the individual varieties is discussed, and their important characters are pointed out.

Tystofte Smaahvede and Extra Squarehead II gave good yields, but showed a comparatively low degree of hardness. Solvete I and Extra Squarehead II proved to be of high disease resistance. Svalöf Sammetsvete, a commonly grown variety used as a standard for comparison with the newer and improved varieties, in one series of 15 tests gave an average yield 12.5 per cent and in another from 14 to 15 per cent under the average yields of Solvete I.

The results secured with Solvete II, a cross between Solvete I and Extra Squarehead II, indicated that the new variety possessed high-yielding capacity, good quality, relative earliness, satisfactory hardness, and improved strength of straw. The average yield of Solvete II for 1914-1921 was 7.3 per cent above the average yield of Solvete I. Pansarvete II ranked first in yield among the varieties tested and showed a high degree of resistance to rust, but proved less resistant to other wheat diseases and had the added disadvantage of a late ripening period to make it a suitable variety for a wide range of localities.

Birgittavete, a cross between Tystofte Smaahvede and Extra Squarehead II also made at Svalöf, showed good yielding capacity and ranked high in disease resistance and in hardness.

Improvement of wheat by selection in New Zealand, F. W. HILGENDORF (In *Wheat Production in New Zealand*, D. B. COPLAND, Auckland, N. Z., Melbourne, and London: Whitcombe & Tombs, Ltd., [1920], pp. 79-96, fig. 1).—A description of the principles of single-head selection, with the details of the development and distribution of Hunters A 1 (Red Chaff) by Lincoln College.

The absorption of moisture by wheat grain and its relation to the humidity of the atmosphere, G. L. SUTTON (*Roy. Soc. West. Aust. Jour. and Proc.*, 6 (1919-20), pt. 2, pp. 75-87, figs. 2).—Lots of Federation, Bunyip, and Comeback varieties of wheat harvested in January were stored in jute grain sacks in an open galvanized shed. Monthly moisture determinations for one year were compared with humidity records for one, two, and three week periods preceding the analyses. The results of the experiment may be summarized as follows:

West Australia wheat as harvested contains about 4 per cent less moisture than is prescribed for the highest grade American wheat. Wheat harvested regularly, November to January, absorbs moisture and gains weight until about October, when the increase amounts to from 5 to 6 per cent. It then loses moisture until January, when the percentage increase remains about 2 per cent above that when harvested. The existence of constant and definite variations in moisture content, between varieties of different types or between the same varieties from different districts, was not demonstrated. There is a correlation between the moisture content of wheat after harvest and the relative humidity of the air, apparently with the mean of a week in the case of small experimental lots, and probably with the mean of about a month with large parcels.

Monthly commercial weighings of wheat sacked in jute and stored in sheds with galvanized iron roofs and jute curtains showed an increase in weight during the wet winter months and a decrease during the dry months, but in no case was the decrease sufficient to bring the weight back to that of the freshly harvested grain.

Proceedings of the twelfth and thirteenth annual meetings of the Association of Official Seed Analysts of North America (*Assoc. Off. Seed Anal. North Amer. Proc.*, 12-13 [1919-20], pp. 71, figs. 2).—Brief résumés of the activities of the association during 1919 and 1920 are included, together with papers presented at the twelfth and thirteenth annual meetings. The following were presented at the twelfth meeting: Notes on Germination of Kentucky Blue Grass, by C. H. Waldron; Physiological Problems in Relation to the Germination of Seeds, by G. T. Harrington; Some Modifications of the Vertical

Air-blast Separator, by O. A. Stevens and H. D. Long; The Identity of Certain Sweet Clover Seed, by E. C. Dahlberg; Tolerance Limits in Weed Seeds, by A. C. Wilson; and Labeling of Field Seeds by Seedsmen, by E. Brown.

In a paper on The Identification of Seed of Italian Alfalfa and Red Clover, F. H. Hillman and H. H. Henry indicate six kinds of incidental seeds found in both alfalfa seed and red clover seed from Italy which, barring insignificant exceptions, were not present in seed of these legumes from any other source. These seeds with the respective percentage of samples of alfalfa and red clover seed which contained them are *Hedysarum coronarium*, 10 per cent, 75 per cent; *Galega* sp., 14, 42; *Trifolium supinum*, 54, 39; *Cephalaria transylvanica*, 43, 34; *Phalaris* sp., 22, 56; and *Valerianella* sp., 4 per cent, 21 per cent.

The results shown in the paper on Color Characteristics of Red Clover Seed, by J. R. Dymond, indicate that purple seeds were slightly more prevalent and had a higher average weight per 1,000 seed than the yellow in red clover seed harvested in Ontario in 1916. The yellow seed gave a higher percentage of germination 32 months after harvest and had more hard seeds than the purple. Green or immature seeds gave the lowest germination, but contained a very high proportion of hard or impermeable seed. Brown seeds were low in vitality and included the smallest amount of hard seeds.

Among papers presented at the thirteenth annual meeting were The Nature and Cause of the Water Sprout Encountered in Germination Testing, by M. T. Munn; The Effect of Commercial Blue Blotting Paper on the Germination of Timothy Seed, by G. T. French; Some Comparative Data on Temperature of Seed Germination, by W. O. Whitcomb; Further Studies of the Fungus Associates of Germination Tests, by M. T. Munn; Sclerema and Hardshell, Two Types of Hardness of the Bean, by W. O. Gloyer; Two Methods of Testing Hairy Vetch Seed for Purity, by J. S. Jones; A Study of the Variations Occurring in Seed Tests and its Relation to the Application of the Tolerance Formula, by E. F. Hopkins and M. T. Munn; An Automatic Incubator to Control Variations of Temperature, by E. C. Vaughn; Shall Impermeable Seeds be Counted as a Part of the Germination Test? by H. Lunz; and What are State Laboratories Doing with Hard Seeds of Legumes and with the Sprouts of Leguminous Seeds Which Break Off Both Cotyledons? by G. T. French.

According to the paper on Correlating Laboratory Tests of Seed Germination with Field Tests, by W. O. Whitcomb, many samples of different kinds of seeds were tested in the laboratory and double rows of 100 seeds each were planted in the field in preliminary tests at the Montana Experiment Station. The respective laboratory germinations and field germinations of the seeds tested were as follows: Wheat, laboratory, 97 per cent, field, 74 per cent; alfalfa, 71, 24; sweet clover, 50, 17; peas, 90, 67; corn, 90, 70; red clover, 59, 21; and flax, 89, 32 per cent.

HORTICULTURE.

Experiments with common rock salt, I-III, W. RUDOLFS (*Soil Sci.*, 12 (1921), No. 6, pp. 449-474).—This is a series of three papers dealing with the effect of rock salt on various plants.

I. *Effect on asparagus* (pp. 449-456).—Studies were conducted at the New Jersey Experiment Stations upon the influence of salt on yield and growth of plants. Plats laid out in the middle of two asparagus fields, one 2 and the other 11 years old, were top-dressed with 150, 300, and 500 lbs. of rock salt in April, 1919, supplementary to liberal fertilization with animal manures. In April, 1920, salt was again applied in similar amounts and in connection with manures. In the initial season the effect on yield in both fields was insignificant; however, the number of stems per plant was increased as shown by counts

made at the end of the growing season. The 2-year field plants on the 150-, 300-, and 500-lb. plats showed respective increases in number of stems over the check plants of 2.9, 16.2, and 26.8 per cent, while in the 11-year field corresponding gains of 2.1, 11.7, and 25.9 per cent were recorded. Incomplete yield records in the spring of 1920 indicated an increase in crop due to salt applications, the largest increases, 17.1 per cent for the young and 11.7 per cent for the old plants, occurring on the plats receiving 500 lbs. of salt. The author, after calling attention to the brief duration of the experiments, points out that the larger applications of salt evidently directly stimulated growth and yield of asparagus.

II. *Eradication of weeds and cleaning of roadsides with salt* (pp. 457-470).—This paper discusses experiments conducted at New Brunswick and Riverton in 1919 and at Hartford in 1920, in which three kinds of salt were tested as mediums for the eradication of weeds and roadside brush. The results indicated that table salt was less effective than rock salt for killing plants. In the order named, grape, five-leaved ivy, poison ivy, wild cherry, hackberry, sumac, and sassafras were difficult to kill, many plants surviving applications of 3 to 4 tons of salt per acre. Midseason proved to be the most effective time for applying salt.

III. *After effects of salt* (pp. 471-474).—This paper deals with studies conducted in the summer of 1919 in a cut-over swamp near New Brunswick, in which stumps were treated with common rock salt. It was observed that salt apparently exerted a stimulating effect on new growth wherever the stumps were not severely injured by the original treatment. Different results were obtained at Bridgeton, where salt applied on and around oak stumps at the rate of 4,200, 4,750, and 5,300 lbs. per acre killed from 60 to 70 per cent of the stumps and injured the remainder. Blueberry plants were found to be very susceptible to salt injury in that all plants were killed upon plats on which salt was broadcasted.

Experiments with fruits and vegetables (*South Carolina Sta. Rpt. 1921, pp. 36-39, 40*).—A report of horticultural activities at the main station and substations.

Variety tests with peaches indicated that Carman, Hiley, Belle of Georgia, and Elberta are of superior merit for commercial planting. The thinning of peaches is deemed to be a profitable practice in that fruits from thinned trees were of larger size, better color, and improved quality. Shiro, Abundance, and Burbank were satisfactory plum varieties. In a test of 120 varieties of northern grapes, Moore Early, Lucile, Delaware, Niagara, and Concord were found of particular value for general planting. Among Muscadine varieties, Eden, James, Scuppernong, Thomas, and Flowers, listed in order of maturity, proved to be of particular value. It is advised that Muscadine varieties be pruned in November by removing a few of the larger canes as contrasted with the usual cutting back. Among the many muskmelon varieties tested, Emerald Gem, Burrell Gem, Jenny Lind, Pollock No. 25, Nutmeg, Extra Early Hackensack, and Hackensack were found of value.

[**Horticultural work in Guam**], G. BRIGGS (*Guam Sta. Rpt. 1920, pp. 49-61, 62-64, fig. 1*).—Tests with various species of fruit and vegetable plants were continued during the year (E. S. R., 45, p. 43). Everbearing strawberries introduced in February, 1920, made splendid growth and produced some fruit. Tests of roselle, including records of yields, indicated that this plant, of use in the preparation of sauces and cool beverages, may be grown to advantage on the island. Papayas produced from seed grown at Guam for four generations were small and of inferior quality.

In a propagation test with several pineapple varieties, suckers proved superior to crowns in all instances, producing more vigorous and earlier fruiting plants. The value of bone meal as a fertilizer for pineapples is indicated in a tabulation of the yields of two varieties, Smooth Cayenne and Red Ceylon (Thorny), treated with several different materials. Cristobal and Hawaiian hybrid tomatoes continued to show merit for Guam conditions, particularly when planted in September and October. Variety tests with lettuce are also reported.

The Lacatan banana, yielding good sized bunches of fine quality fruits, is deemed the most promising variety for local conditions. In a test of the effect of various fertilizers and of grass upon the growth of young coconut trees, results of which are shown in tabular form, the best growth was obtained on the control plat from which Para grass had been removed. Although dynamiting assisted in loosening the soil between coconut trees, no material advantage could be detected in favor of this treatment. The importance of the coconut to Guam is indicated by the table showing the amount and value of copra exported since 1900. Recommendations are given whereby, through proper curing practices, it is expected that the quality of copra may be greatly improved and its market value enhanced. A tentative copra score card for use in boys' and girls' clubs is included.

Plant breeding activities at Proskau, F. HERMANN (*Landw. Jahrb.*, 56 (1921), *Ergänzungs*b. 1, pp. 106-113, figs. 2).—In a study of the comparative value of mass and individual plant selection with the Hinrichs Risien bean, the results greatly favored individual selection. Three consecutive years of mass selection begun in 1911 with two lots of seed, one averaging 56 gm. and the other 40 gm. per 100 individuals, resulted in seeds weighing 50 gm. and 44 gm. per 100, respectively. Furthermore, observations upon the individual plants showed that neither strain was homozygous for size of seed. Better results were obtained in a single year of unit plant selection started in 1913 with seed of plants from the mass selection experiment. The original beans averaged 55.5 and 36.25 gm. per 100 seed, and at the end of the first season the progeny averaged 52 and 41 gm., respectively.

Interesting results were obtained in pollination studies with the tomato. Emasculated blooms openly exposed to wind and insects failed to produce, although in 29 out of 105 instances there was a partial development of seedless fruits. On the other hand, normal fruits developed from untreated blossoms inclosed in paper sacks. Despite these results, the author concludes that covering the blooms is a necessary operation in technical plant breeding studies. Several methods of technique were compared in an effort to determine the effect of covering fruits on the number and viability of the resulting seeds. Based on the results of a three-year study, the average viability of seed from protected fruits was 35 per cent and from unprotected 80 per cent. Furthermore, the number of seeds in proportion to fruit was much less in the case of the protected individuals. In studies with the Prince Borghese variety, seed from normally exposed fruits proved 100 per cent viable, as contrasted with 53 per cent for naturally pollinated inclosed fruits; 61 per cent for hand-pollinated inclosed fruits, and 74 per cent for fruits inclosed in gauze sacks. Similar variations were recorded for the King Humbert variety. In the cold, wet season of 1919, seed from paper-inclosed fruits of King Humbert germinated only 6 per cent, while those of artificially pollinated fruits proved 40 per cent viable. The various results are believed to be of value in explaining the poor sets of fruits often obtained in greenhouses and to emphasize the need of artificial pollination under such conditions.

In 1913 a single plant was observed among 25 of the Paragon tomato which was peculiarly free from leaf roll even into the late fall. Among 10 plants

raised from selfed seed of this individual, only 2 showed symptoms of the disease. Resistance was apparent in the third generation when plants of the improved strain were submitted to a severe test by interplanting among those of a very susceptible variety, the Schöne Lothringerin.

In a study of the effect of increased soil fertility upon the character of bloom of garden stocks, *Matthiola* sp., it was found that abundant manuring for two successive generations exerted no appreciable effect upon the percentage of double blossoms in the progeny.

Report of the experimental work in the Ganeshkhind Botanical Garden [Poona district] for the years 1916-1920, W. BURNS (*Bombay Dept. Agr., Ganeshkhind Bot. Gard., Kirkee, Rpt. Expt. Work, 1916-1920, pp. 17*).—In this brief progress report (*E. S. R.*, 46, p. 640), data are presented relative to various experimental activities during the four years ended 1919-20.

Reciprocal crosses made in 1918-19 between the navel orange and the pomelo failed to result in any viable seed.

No success was attained in an attempt to develop a guava with less seeds by interbreeding between several species; however, a superior variety possessing relatively few seeds was discovered in Hyderabad, Sind. Pruning tests with the guava, of which data are presented in tabular form, show rather contradictory results. In the majority of instances a greater number of fruits were obtained from unpruned trees; however, those of the pruned trees were larger, better colored, and more desirable for marketing purposes.

An attempt to produce a papaya stock containing a predominance of female trees by crossing a pure female with pollen from a perfect tree resulted in a distribution of sexes in the third generation of 21 staminate, 15 pistillate, and 6 perfect trees. From these results it is concluded that it is impossible to fix the female character by this method.

Among American grape varieties introduced during the period 1913-1915, Herbert, Concord, Campbell Early, Niagara, Duchess, Early Victor, and Barry have survived, but without showing any promise.

Alternate bearing of fruit trees, H. B. TUKEY (*Science, n. ser.*, 55 (1922), No. 1418, p. 241).—A brief note containing a quotation² describing a successful attempt to change the bearing year of the Baldwin apple by removal of the blooms.

The apple tree, L. H. BAILEY (*New York: Macmillan Co., 1922, 117, pls. 8, figs. 8*).—In this small book, the first in a proposed series entitled *The Open Country Books*, various phases in the life history and development of an apple tree, including budding, grafting, pruning, repairing, and fruit bud and fruit formation are discussed in plain, nontechnical language.

Studies in apple tree planting, SCHINDLER (*Landw. Jahrb.*, 56 (1921), *Ergänzungs*b. 1, pp. 25-28, figs. 3).—Depth of planting studies conducted with Lord Grosvenor apple trees on a light, sandy soil at the Proskau Experiment Station indicated the superior merit of shallow planting, in that at the end of six years those trees set with their crowns level with the surface of the soil had attained the greatest size, averaging 54.3 in. across the top as compared with 38.6 in. for the deepest set trees. Although the root development of the deeply planted trees was also inhibited, a tendency was observed for such trees to recuperate, their roots rising vertically toward the surface, and when reaching the proper level spreading in a normal manner. In this way several of the trees had partly recovered from the handicap of deep planting. The author believes that greater injury would occur with trees planted in heavy clay soils.

² *Mag. Hort.*, 13 (1847), p. 438.

Bracing apple trees, P. THAYER (*Ohio Sta. Mo. Bul.*, 6 (1921), No. 11-12, pp. 172-175, figs. 4).—A brief illustrated article containing suggestions relative to two methods, namely intertwining of living branches and iron rod bracing, for strengthening the frame work of fruit trees, with the object of increasing resistance to storms and extra heavy crops of fruit.

Pear pruning by the Caldwell method, W. A. CALDWELL (*Calif. Countryman*, 7 (1921), No. 7, pp. 5, 15, 23, fig. 1).—A description of a unique and successful method of training pear and plum trees wherein the long upright shoots, instead of being cut back, are bent down and tied in a horizontal position. As a result, many small shoots appear along the horizontal stem, which in turn produce abundant fruit buds, resulting in a greatly increased production of fruit.

The effects of fertilizers on the composition of cherries, KOCHS (*Landw. Jahrb.*, 56 (1921), *Ergänzungs.* 1, pp. 67-69).—A report of studies conducted at the Dahlem Station pertaining to the effect of modifications in fertilizer formulas upon the character of cherry fruits. The use of a complete fertilizer containing nitrogen, phosphoric acid, potassium, and calcium resulted in a greater proportion of flesh, higher sugar content, and a decrease in acids and ash as compared with fruits from trees treated with two similar fertilizers, one lacking in calcium and the other in potassium. Analyses of the stones, including the kernels, from the respective plats showed an increase in fats and albumin in response to applications of the complete fertilizer. Much of the data is presented in tabular form.

Grape production and distribution in western Iowa, T. J. MANEY (*Iowa Sta. Bul.* 199 (1921), pp. 377-399, figs. 10).—This is a detailed study of the grape industry centering about Council Bluffs, Iowa, with particular reference to various factors which are deemed fundamental to the success of the enterprise. Climate, soil, and topography of the land are said to peculiarly favor grape growing, and comparative freedom from serious insect and fungus pests is enjoyed. The Concord comprises 90 per cent of the total acreage, and ripening earlier than in the northern grape belt, the crop is readily disposed of before the height of the season. The keystone to success has been an association of growers, which for several years has effectively handled approximately 90 per cent of the commercial crop. Transportation facilities are described as specially favorable for the distribution of perishable crops, and on account of proximity to an immense consuming territory the future of the industry is deemed to be most promising. The average yield per acre ranges from 612 to 1,000 6-lb. baskets according to the size of the vineyard. The cost of production is estimated at \$143.75 per acre and the gross receipts at \$261.40, leaving a balance of profit of \$117.65. With more careful attention to cultural practices it is believed that the profits may be materially increased.

Viticultural studies at Geisenheim, BIERMANN (*Landw. Jahrb.*, 56 (1921), *Ergänzungs.* 1, pp. 9-12, 13, 14).—Records taken in June and August upon the length and diameter of the new growth of grape vines, set on March 22, May 3, and May 31 and pruned to a single stem, indicated the advantage of early planting. The greatest number of living plants was also recorded in the lot planted on March 22. The value of early disbudding was indicated by the increased productivity of vines thinned on May 22 as compared with vines similarly treated on June 5, 12, and 19.

Multiformity in the coconut, I. BOLDINGH (*Dept. Landb., Nijv. en Handel [Dutch East Indies], Meded. Afdeel. Zaadteelt*, No. 1 (1920), pp. 20, pls. 49).—Careful studies of the coconut revealed the existence of many distinct types and forms differing radically in their producing capacities. In addition to de-

scriptive data, tabulations are presented relative to the weight of nuts, net yield of copra, etc., from eight different types.

FORESTRY.

Manual of the trees of North America (exclusive of Mexico), C. S. SARGENT (Boston: Houghton, Mifflin Co., 1922, 2. ed., pp. XXVI+910, pl. 1, figs. 783).—This enlarged and revised edition (E. S. R., 16, p. 978) includes representatives of 4 families and 16 genera not appearing in the first edition.

Little known but commercially important trees of the West Indies, C. D. MELL (Bul. Pan Amer. Union, 54 (1922), No. 2, pp. 149-157, figs. 6).—This paper deals with the economic value of three tropical trees, namely, *Mammea americana*, *Moringa pterygosperma*, and *Albizia lebbek*.

American trees in Scotland, J. SUTHERLAND (Jour. Forestry, 20 (1922), No. 1, pp. 71-74).—Among 11 species of American forest trees introduced into Scotland, two, Douglas spruce and Sitka spruce, have proved of particular value as indicated by growth measurements given for plantations of each species. An individual Douglas spruce planted in central Scotland in 1834 had attained a height of 115 ft. with a quarter girth content of 573 cu. ft. Brief notes are given relative to the behavior of the other nine species. A hybrid larch (*Larix europae* × *L. leptolepis*), described as of rapid, straight growth and of singular freedom from disease, is recommended to the attention of American foresters.

Bibliography of the woods of the world, S. J. RECORD (New Haven, Conn.: Author, 1922, pp. 28).—This bibliography, presented in mimeographed form, treats particularly of tropical woods. Those species occurring in the temperate zone of North America are purposely excluded.

Descriptions of three new species of Eucalyptus, J. H. MAIDEN (Roy. Soc. N. S. Wales, Jour. and Proc., 54 (1920), pp. 66-73).—As a further contribution to the subject (E. S. R., 45, p. 141), technical descriptions are given for three newly recognized species of Eucalyptus.

Correlation in structure between mother and daughter trees of Hevea, C. D. LA RUE (Arch. Rubbercult. Nederland. Indië, 5 (1921), No. 12, pp. 567-573).—Several progenies consisting of 1.5-year-old Hevea seedlings obtained by open pollination of mother trees of known history were carefully studied in an attempt to ascertain the relation in form and structure existing between parent and daughter trees.

Externally, as great variation was apparent between related seedlings as between those from different parents. The bark thickness in the seedlings varied from 0.5 to 3 mm. with a coefficient of correlation between mother and daughter trees of 0.366, which figure the author believes to indicate that this character is transmitted to a certain degree. There was no apparent correlation between the number of latex vessel rings of parent and of progeny, leading the author to conclude that there is little probability of yield being transmitted in the case of open pollination. Controlled breeding with high producing male and female parents is deemed to be more likely of success.

Thinning according to bark investigation on the Government rubber estate "Vada," W. BOBILIOFF and C. A. GEHLSSEN (Arch. Rubbercult. Nederland. Indië, 5 (1921), No. 8, pp. 406-445).—In comparing examinations of bark with determinations of yield as a means of ascertaining which trees shall be thinned from Hevea plantations, bark examination proved the more satisfactory means, in three instances to one giving the better results. The ratio between the yields before and after thinning was 106.4 per cent for bark examined

trees and 98.4 per cent for those trees thinned according to yield records, further indicating the real superiority of the bark method.

Regeneration in the heath forests of Finnish Lapland, V. T. AALTONEN (*Commun. Inst. Quaest. Forest, Finland, No. 1 (1919), pp. IX+319+56, pls. 29, figs. 55*).—Reproduction on dry heath soils was observed to be characterized by the appearance of a thick stand of seedlings grouped about isolated seed trees. In thicker stands of the old trees under conditions of insufficient light, young trees were observed to thrive for a short period and then gradually to succumb. Observations upon the influence of ground cover led to the conclusion that such plants had no particular significance in forest reproduction except in hindering seed from penetrating the soil and in competing for nourishment; however, the ground cover was found of great value as an indicator of the character of the soil.

Studies of crown contact showed that the greater the contact the greater the suffering on the part of the underlying trees, especially on poor soils and in older stands. The author, in discussing the comparative importance of insufficient light and lack of nourishment as a cause of decline in young trees, believes the latter factor of greater significance than usually accepted. No evidence was obtained to indicate that reindeer were of much importance in preventing reproduction. Studies in the winter of 1917, during the period of deep snow, indicated that no serious damage originated from this source, and, with the exception of very sandy types of soil, no injury was apparent from the alternate freezes and thaws of early spring. A fungus, *Phacidium infestans*, was found to cause considerable injury to young Scotch pines.

First results in the stream flow experiment, Wagon Wheel Gap, Colo., C. G. BATES (*Jour. Forestry, 19 (1921), No. 4, pp. 402-408*).—A progress report covering the period October 1, 1919, to September 20, 1920, relative to an experiment initiated in 1910 by the U. S. D. A. Forest Service and Weather Bureau for the purpose of determining the effect of forest cover upon the flow of streams. The activities previous to July, 1919, were of a preparatory nature and were devoted to recording the flows previous to deforestation and to perfecting methods of technique (see p. 779). Actual deforestation was begun in July, 1919, and completed in September, 1920. Records of flow for the different seasons of the experimental year are presented in tabular form with discussion.

Removal of the forest cover resulted in earlier melting of the snow and in an increased rate of discharge during the flood period, which extended from April 8 to July 13, 1920. During the latter half of July the flow of the stream from the denuded area was nearly normal, while in August and September there was a slight increase, believed to be due to the effect of rains and the absence of trees requiring water in their processes of transpiration. The excess of measurable detritus carried away by the stream arising in the deforested area amounted to 125 per cent and was for the most part recorded during the period of the flood.

Damage to forests and other vegetation by smoke, ash, and fumes from manufacturing plants in Naugatuck Valley, Conn., J. W. TOUMEY (*Jour. Forestry, 19 (1921), No. 4, pp. 367-373, pls. 2*).—The vegetation of the Naugatuck Valley is believed to have suffered severely as a result of extended manufacturing activities during the recent war. The increase in poisonous gases and smoke seems to have been particularly destructive to coniferous species, which are noted as on the decline. In the immediate vicinity of factories, grass and vegetable gardens were also injured.

Believing that sulphur dioxide from coal burning plants and zinc sulphate from brass works were the active agents of injury, the author conducted, in the

summer of 1920, an experiment to determine the effect of excessive applications of flue dust, collected from the chimneys of brass mills, upon grass. No apparent injury was caused by applications of less than 25 gm. per sq. ft., but beyond this figure injury increased until total killing was reached at 200 gm. The addition of an equal part of slaked lime prevented injury even when 200 gm. of flue dust were used, and furthermore, the combination apparently stimulated growth even more than when lime was used alone. The author concludes that injury to surface rooted vegetation from the dust of brass works may be prevented by previous applications of slaked lime.

Handbook of field and office problems in forest mensuration, H. WINKENWERDER and E. T. CLARK (*New York: John Wiley & Sons, Inc.; London: Chapman & Hall, Ltd., 1922, 2. ed., pp. IX+133, fig. 1*).—This is an enlarged and revised edition of a previously noted work (*E. S. R., 33, p. 298*), in which the information has been changed to be of use to practical as well as educational men.

The alinement chart method of preparing tree volume tables, D. BRUCE (*Calif. Univ. Pubs. Agr. Sci., 4 (1921), No. 9, pp. 233-245, figs. 3*).—An alinement chart is described which is recommended as suitable for the preparation of tree volume tables, although the form of the equation of a desired table is yet unknown.

Wood-using industries of New York, R. V. REYNOLDS and R. J. HOYLE (*N. Y. State Col. Forestry, Syracuse Univ., Tech. Pub. 14 (1921), pp. 231, figs. 14*).—This joint contribution from the New York State College of Forestry and the U. S. D. A. Forest Service, in part a revision of an earlier publication bearing the same title (*E. S. R., 30, p. 536*), presents the results of a survey of the wood-using industries of New York State conducted during the calendar year 1919. Data are given relative to the consumption and value of different species of domestic and imported woods, including tabulated lists of products and of kinds of wood used in their manufacture. A directory of firms is included, classified according to the articles produced. The rapid decline in lumber production in New York in recent years is emphasized by a chart showing graphically the decrease in lumber cut and in total forest products.

Research work of the Dominion Forest Service, W. G. WRIGHT (*Jour. Forestry, 20 (1922), No. 1, pp. 62-66*).—A paper delivered before the forestry section of the American Association for the Advancement of Science at Toronto, December 27, 1921, presenting a brief outline of official forestry investigations in progress in Canada.

Report on forestry for the year ended June 30, 1921, L. G. IRBY (*Tasmania Forestry Dept. Rpt. 1921, pp. 11, pls. 4, figs. 1*).—This is the first annual report of the Forestry Department, created by an act which became effective January 1, 1921.

DISEASES OF PLANTS.

Plant pathology: Its status and its outlook, J. H. FAULL (*Roy. Soc. Canada, Proc. and Trans., 3. ser., 14 (1920), Sect. V, pp. 1-16*).—A review of the whole development of plant pathology, with an account of recent losses due to certain plant diseases, includes a statement, with discussion, of the problems of plant-disease control, namely, sprays and dips, improvement of environmental conditions, eradication, exclusion, and breeding for resistance, this last being regarded as the ideal means for both producer and pathologist.

Studies on the physiology of some plant pathogenic bacteria (*North Carolina Sta. Tech. Bul. 20 (1921), pp. 47, fig. 1*).—Accounts are given of investigations at the station on the physiology of a number of species of bacteria.

Solid culture media with a wide range of hydrogen and hydroxyl ion concentration, F. A. Wolf and I. V. Shunk (pp. 3-7).—The authors report that agar or gelatin media, if cooled before being made acid or alkaline, will jellify at limits far beyond pH concentrations tolerated by microorganisms. The media may then be manipulated so as to avoid contamination during the adjustment of the reaction and need not be subsequently sterilized.

Further studies on bacterial blight of soy bean, I. V. Shunk and F. A. Wolf (pp. 8-13).—Attention is called to two papers that have been published on bacterial blight of soy bean (E. S. R., 42, p. 352; 45, p. 545), in which the disease is attributed to *Bacterium glycineum* and *B. sojae*. Four strains of the organism from Wisconsin and one from North Carolina have been studied, and the comparison made showed that the diseases differ somewhat in appearance. These differences are said to be of minor importance and it is considered doubtful whether they could be differentiated with certainty in the field. By the use of certain easily operable refinements, it was found that the several strains of bacteria pathogenic to soy beans represent two distinct species, *B. glycineum* and *B. sojae*. Both organisms have been isolated in Wisconsin and proved to be pathogenic, but *B. sojae* alone has been found to be associated with soy bean blight in North Carolina.

Tolerance to acids of certain bacterial plant pathogens, F. A. Wolf and I. V. Shunk (pp. 14-20).—Cultural studies on the tolerance to acids of the cabbage black rot organism, an organism causing decay of root crops, two causing leaf spots of soy bean, and two causing leaf spots of tobacco showed that different acids of the same hydrogen-ion concentration are not able to exert the same influence in inhibiting cell multiplication. Acetic acid was found more toxic than any of the other acids employed. A greater pH concentration in agar than in bouillon is required to inhibit growth, this difference ranging between 0.2 and 0.4 pH with the same organism and the same acid.

Thermal death points of some bacterial plant pathogens in relation to reaction of the medium, F. A. Wolf and A. C. Foster (pp. 21-24).—Studies are reported on the hydrogen-ion concentration as related to the thermal death point of several species of bacteria. The data reported confirmed the idea that the concentration of hydrogen ions is an agent of great significance in cellular destruction at high temperatures.

The fermentative activity of some plant pathogenic bacteria in relation to hydrogen-ion concentration, F. A. Wolf and A. C. Foster (pp. 25-43).—Studies were made of the fermentative activity of *Bacillus carotovorus*, *Bacterium tabacum*, *B. angulatum*, *B. glycineum*, *B. sojae*, and *B. campestre* as influenced by initial reaction, concentration and kind of carbohydrate, concentration of buffer material, and mechanical agitation. All were found to grow at a fairly uniform rate over a wide range of initial reaction, and the initial reaction of cultures of these organisms was found to be one of the factors which exerts an influence in modifying the final reaction in any given medium. Each organism appeared to require a definite concentration of carbohydrate in a given medium if it should produce its characteristic final reaction. Fermentable sugars were not attacked with equal vigor, since the rate and amount of fermentation vary both with the species of organism and the kind of carbohydrate.

The application of certain recent studies on technic to methods of culture of plant pathogens, F. A. Wolf (pp. 44-47).—Attention is called to some recent improvements and refinements in technic as regards measurement of acidity, fermentation, thermal death point, nitrate reduction, tolerance to acid or alkali, and preparation of agar, which the author considers are applicable in cultural studies of bacterial plant parasites.

Plant diseases (*South Carolina Sta. Rpt. 1921, pp. 17-22, figs. 4*).—Notes are given on studies of cotton anthracnose, angular leaf spot, a new cotton disease, and on a plant disease survey carried on by the station. With anthracnose, experiments conducted to determine the effect on the fungus of seed treatments and methods of storing the seeds are reported, and it appears that different methods of drying the seed did not reduce infection to any marked extent. Field studies of selections indicated that certain strains of varieties commonly infected with anthracnose were free from disease.

On the control of angular leaf spot, the former conclusions (E. S. R., 41, p. 50) have been confirmed. As a result of these investigations, the station recommends the delinting of cotton seed with sulphuric acid as a means not only for the control of the angular leaf spot, but also in reducing anthracnose infection and hastening the germination of the seed.

A cotton disease causing a constriction of the stalk that kills the plant at the surface of the soil has been investigated and several fungi isolated, one of which seems to be capable of producing the disease on healthy cotton plants. This investigation is being continued.

Plant diseases [in England], R. H. BIFFEN (*Jour. Roy. Agr. Soc. England, 81 (1920), pp. 244, 245*).—In this portion of the botanist's report for 1920, it is stated that plum withertip seriously crippled many orchards, though considerable recovery was made during the season. Apple mildew appears to be increasing annually in prevalence and severity. Attack on the mildew by another fungus (*Cicinnobolus* sp.) did not much lessen its capacity for spore formation. Destruction of affected shoots prevents serious effects from the mildew. Other fruit diseases reported were cherry leaf scorch; peach mildew and leaf curl; apple scab, bitter rot, and canker; American gooseberry mildew; and a disease of strawberry plants due to *Botrytis* in the crowns.

Bunt infection of Benefactor wheat was noted as being associated in some cases with greater length and looseness in the ears. Blowing out bunted grains from seed wheat is not adequately protective, nor is the copper sulphate treatment as ordinarily carried out. Mildew was again abundant in wheat and oats.

Reports sent in related to potato curl, corky scab, and blackleg; mangel rust; red clover rust and mildew; sainfoin showing clover sickness; pea mildew; bean rust; (stock) cabbage heart rot; and forest tree rots (mainly *Polyporus* spp.).

The phytopathological service in the Netherlands (*Verlag. en Meded. Phytopath. Dienst Wageningen, No. 13a (1921), pp. 8, pl. 1*).—An outline is given of the organization and activities of the phytopathological service for the Netherlands, including work with insect pests.

Phytopathological observations [in the Netherlands], I, II (*Verlag. en Meded. Phytopath. Dienst Wageningen, No. 18 (1921), pp. 20, pl. 1, fig. 1; Verlag. en Meded. Plantenziektenkund. Dienst Wageningen, No. 22 (1921), pp. 25, pls. 2, figs. 6*).—In this series, short articles are contributed as follows: An Obscure Disease of Yew, by D. Spierenburg; Insect Injury to *Cattleya*, by T. A. C. Schoevers; Seed Treatment for Prevention of Wheat Stinking Smut, by C. van den Berg; Potato Disease in the South of Holland, by G. A. van der Waal and W. B. L. Verhoeven; Gall Formation in *Arabis apina*, by T. A. C. Schoevers; and Bird Raising in Orchards, by C. Groot.

Notes on diseases of economic plants in Indo-China and Siam, O. A. REINKING (*Philippine Agr., 9 (1921), No. 6-7, pp. 181-183*).—The list of fungi on economic plants here noted was prepared by the author from his collections made in June and July, 1920, during an investigation of citrus diseases. An account of the disease of citrus in Indo-China and Siam is not included, as it appears in the article noted on page 746. The diseases here given undoubtedly

comprise only a part of the fungi attacking plants, as the investigation was made during the extreme dry season. Hosts are arranged alphabetically for each country.

Control of plant diseases in small gardens, I, II (*Verslag. en Meded. Plantenziektenkund. Dienst Wageningen*, Nos. 19 (1921), pp. 20, pls. 3; 21, pp. 18, pls. 5).—These two communications from the inspector of the phytopathological service deal with both plant diseases and insect enemies and with protective measures. The first is concerned mainly with facts appropriate to winter conditions, the second with such as relate more directly to warmer weather (April to October).

Diseases and disease fungi in Poland and Masurenland, R. LAUBERT (*Centbl. Bakt. [etc.]*, 2. Abt., 52 (1920), No. 9-12, pp. 236-244).—This includes an enumeration of plant disease fungi, also of galls and other malformations observed during 1915 to 1918 in Poland and Masurenland.

Diseases of crops [in India], [S. MILLIGAN] (*India [Dept. Agr.] Rev. Operations, 1919-20*, pp. 47, 48).—A study has been taken up at Pusa and is expected to continue for several years on *Helminthosporium* and allied species attacking cereals throughout the country. An allied fungus (*Acrothecium* sp.), parasitic on several grains, has been named *A. penniseti*. Another species (*A. lunatum*) is common at Pusa on maize and sorghum and is sometimes associated with *A. falcatum*. Foot rot is here associated most notably with a *Fusarium*.

Prevention of bunt in wheat, E. S. SALMON and H. WORMALD (*Jour. Min. Agr. [London]*, 27 (1921), No. 11, pp. 1013-1021, fig. 1).—In 1918 an exceptionally severe outbreak of bunt occurred on the variety Red Standard in a field of the Southeastern Agricultural College, Wye, Kent. This provided material for producing artificially severe outbreaks of bunt for experimental purposes and for testing the effectiveness of fungicides.

Preliminary germination tests showed that 10 per cent copper sulphate reduced the vitality of seed wheat, rendering such treatment impracticable, and after further tests it was decided to employ copper sulphate of not more than 2.5 per cent strength. The use of formalin has been attended with satisfactory results in two years' field experiments which are described herein. Formalin at a strength of 1:320, or 1 pint to 40 gal. water, proved to be as effective in bunt control as the 1:240 solution, and is therefore preferred. One gallon of solution is sufficient for thorough treatment of 2 bu. of seed wheat.

Formalin at the strength recommended and copper sulphate solution at 2.5 per cent show a tendency to reduce slightly the percentage of germination, so that treated seed should be sown a little thicker than normal.

The presoak method of treating seed wheat for bunt, W. M. CARNE (*Agr. Gaz. N. S. Wales*, 32 (1921), No. 9, p. 626).—In order to test the value of the presoak plan recommended by Braun (*E. S. R.*, 43, p. 844), experiments were carried out at Hawkesbury Agricultural College with Hard Federation wheat previously cleared of small, broken, and light seeds. The two dipping solutions employed were (1) 6 lbs. copper sulphate to 40 gal. water followed by dipping in limewater, and (2) 1 lb. formalin to 40 gal. water. Tests were made with these solutions by the ordinary and by the presoak method.

The method employing formalin gave no improvement. Slight improvements were found in germination and quickness of germination when the presoak method was used with copper sulphate as compared with the ordinary method.

Owing to the extra work involved in the presoak system, its adoption is not considered justifiable with copper sulphate. The presoak system with formalin appeared to be detrimental.

Die-back of chilies in Bihar, J. F. DASTUR (*India Dept. Agr. Mem., Bot. Ser., 11* (1921), No. 5, pp. 129-144, pls. 2).—The most serious disease of chilies (*Capsicum annuum* and *C. frutescens*) in Bihar is said to be die-back (*Vermicularia capsici*). This causes much crop loss in wet years during late September and early October, spreading virulently from field to field, but, in case of plants not killed, is checked on the appearance of dry, cold weather, with recovery.

Plants in shade escape severe infection, as do also those of the late sown crop. Infection usually commences at growing points or flower buds, causing die-back. Infected fruits show spots when ripe, late maturing fruits being usually free from the disease.

Seeds may become infected, the hyphae appearing in both seed coats and inner tissues and if extensive, impairing germination.

High humidity is a condition of infection and a factor in virulence, especially when it rises above 85 per cent in late September. Burgundy mixture is valuable as a means of control.

Wilt of white clover, due to *Brachysporium trifolii*, L. BONAR (*Phytopathology, 10* (1920), No. 10, pp. 435-441, figs. 3).—An account is given of a peculiar disease condition observed in 1919 by C. H. Kauffman on a plat of white clover on a lawn at Takoma Park, D. C. The first noticeable effect of the disease was shown in the wilted condition of the attacked clover plants, and later all the leaves and petioles of the plants in the affected area became light brown in color, as well as shriveled and dry. The disease appeared in spots, which spread until the whole lawn became a withered brown mass.

As a result of studies, the author believes that the disease in question is due to a distinct and undescribed fungus, a technical description of which is given by Kauffman.

The biology of *Uromyces* attacking *Trifoliums*, F. KOBEL (*Centbl. Bakt. [etc.], 2. Abt., 52* (1920), No. 9-12, pp. 215-235, figs. 3).—The present study deals in detail with the biology of *U. trifolii*, *U. trifolii-hybridi*, *U. trifolii-repentis*, *U. flectens*, and *U. minor*, as found on different clovers.

A preliminary study of the purple leaf sheath spot of corn, L. W. DURRELL (*Phytopathology, 10* (1920), No. 11, pp. 487-495, figs. 6).—This is a detailed account of the investigation previously noted (E. S. R., 44, p. 542).

Ameboid bodies associated with *Hippeastrum* mosaic, L. O. KUNKEL (*Science, n. ser., 55* (1922), No. 1412, p. 73).—In a previous publication (E. S. R., 46, p. 344) the author described the occurrence of certain ameboid bodies in the cells of corn plants suffering from mosaic disease and suggested that they might be of etiological significance. Further work on mosaic disease has revealed the presence of similar bodies in the light green portions of mosaic leaves of *H. equestre*, a plant not closely related to corn.

Investigations on flax diseases, G. H. PETHYBRIDGE and H. A. LAFFERTY (*Ireland Dept. Agr. and Tech. Instr. Jour., 20* (1920), No. 3, pp. 325-342, pls. 6).—Up to the present time it has been found possible to distinguish as definite flax diseases seedling blight (*Colletotrichum linicolum*), browning (undetermined fungus), rust (*Melampsora lini*), and firing due to the same fungus. Yellowing is a popular name, possibly covering more than one disease, but limited for the present to a somewhat definite malady not yet associated with any parasite. The term "dead stalks" has been applied to what are probably at least three distinct diseases which are being investigated.

The report also deals with attacks by the flax flea-beetle (*Longitarsus parvulus*) and by dodder (*Cuscuta epilinum*).

Black scab in potatoes (*Ireland Dept. Agr. and Tech. Instr. Jour., 20* (1920), No. 3, pp. 413, 414).—Information is briefly given regarding black scab, includ-

ing names of 4 particularly susceptible potato varieties and of 15 varieties which are said to be immune.

Black scab (wart disease) in the Netherlands (*Verslag. en Meded. Phytopath. Dienst Wageningen, No. 16a (1921), pp. 18, pls. 5*).—An account in English is given of black scab or wart disease (*Chrysophlyctis endobiotica*) in the Netherlands, showing five areas to be infected, all in the northeastern part of the country.

This disease, which is said to cause in Holland deformation of the tubers, stolons, stems, and low leaves, but not to attack at more than 6 in. above the ground, is stated to attack in England even the flower petals. It is stated that soil once infected may remain so for 10 years or more. The organism has been known to infect *Solanum dulcamara* and *S. nigrum*, but not under natural conditions.

The life history of the organism is outlined, with an account of its ravages outside and more particularly in the Netherlands. Apparently, the disease has been attacking potatoes in the Netherlands since 1907.

Information bearing upon preventive measures includes figures on relative resistance and regulations.

Filosity in potato, S. MOTTET (*Jour. Agr. Prat., n. ser., 35 (1921), No. 21, pp. 414-416*).—Among the possible factors contributory to the supposedly complex causation of filosity in potato plantlets are mentioned dryness and heat leading to precocious maturity of the tuber, also Phytophthora attack leading to early defoliation. Other important factors are briefly discussed.

Potato spindling sprout, S. MOTTET (*Jour. Agr. Prat., n. ser., 35 (1921), No. 18, pp. 349, 350, fig. 1*).—Sprout weakness differing in degree as between sprouts produced on the same tuber is noted as evidencing independence in the separate sprouts, and presumably also a mere alimentary function of the tuber as a whole. Such seed tubers, readily escaping attention, are regarded as more detrimental than those producing only spindling sprouts. It is estimated that each individual of such defective tubers used for seed may condition a crop loss of at least as much as 1 kg., due wholly to this preventable cause.

Preliminary note on the etiology of potato tipburn, J. R. EYER (*Science, n. ser., 55 (1922), No. 1416, pp. 180, 181*).—The results are given of experiments carried on at the Pennsylvania Experiment Station to determine the etiology and specificity of the potato tipburn caused by the feeding of the potato leafhopper (*Empoasca mali*). Plants were inoculated with aqueous and alcoholic extracts of *E. mali* and other potato feeding insects, and later subjected to sunlight of varied intensity.

The results obtained from the experiments are held to show that tipburn of potato plants may be produced by the extract made from macerated nymph or adult of *E. mali* and is transmitted by direct inoculation. The active principle of the specific substance is most virulent in the nymphal stage of the leafhopper, and this specific material is present in diseased leaf tissue after infection by the leafhopper and may be transmitted to healthy plants by re-inoculation. This substance is held to be specific, and it is claimed that the disease can not be simulated by inoculation with extracts from or by feeding of insects other than *E. mali*, or by mechanical injury.

Sunlight was found to be an important factor in the progress of tipburn after its inception, but the absence of sunlight did not prevent the occurrence of the disease.

Animal and plant diseases of the sugar beet, A. STIFT (*Centbl. Bakt. [etc.], 2. Abt., 52 (1920), No. 9-12, pp. 244-252*).—This contains a résumé of important information appearing in 1919 on plant enemies, including nematodes and diseases of the sugar beet.

Diseases in tomato seedlings, G. P. DARNELL-SMITH (*Agr. Gaz. N. S. Wales*, 32 (1921), No. 8, p. 577).—Leaf spot (*Septoria lycopersici*) and blight (*Phytophthora* sp.) were prevalent in 1920 and appeared early in July, 1921. Control measures are indicated.

Overwintering of spotted wilt of tomatoes, C. O. HAMBLIN (*Agr. Gaz. N. S. Wales*, 32 (1921), No. 8, p. 547).—Of tomato vines affected with spotted wilt, kept under observation throughout the winter, one showed typical wilt symptoms (bronzing of leaves and young shoots). Though the exact method of transmission from plant to plant is unknown, it is recommended that all old vines be destroyed in early spring.

Collar rot of apple trees in the Yakima Valley, J. W. HOTSON (*Phytopathology*, 10 (1920), No. 11, pp. 465-486, figs. 15).—A general survey of orchards in Washington is said to have shown the prevalence of a disease known as collar rot or crown rot, and the author gives the results of an investigation carried on in the Yakima Valley to determine the cause of this disease and methods for its control.

The only condition essential for the development of collar rot or crown rot appeared to be a permanent wound of the bark at or near the crown of a fruit tree, and apparently there was little difference as to the cause of these lesions. Attempts were made to isolate definite organisms from the collar cankers, and in some cases *Armillaria mellea*, *Polystictus versicolor*, and *Bacillus amylovorus* were obtained. It is believed that a majority of cankers whose primary cause could not be definitely determined were initiated by the fire-blight organism. Other causes, such as gopher injury, injury due to cultivation, frost or winter injury, defective graft union, hardpan root injury, and arsenate of lead injury are believed to be responsible for the initial development of collar lesions.

The author believes that there are at least two important factors at work in preventing the normal healing of crown lesions, and therefore in promoting the characteristic disintegration of the tissue known as collar rot. These are the presence of the woolly aphid and a saturated condition of the soil, particularly if the soil water is charged with alkali salts.

The only method of treatment suggested is the cutting out of diseased tissue, washing the wounds, disinfecting them, and leaving them exposed to the air. Where injury is severe when it is discovered, the removal of the tree is recommended.

[Grape diseases], L. RAVAZ (*Prog. Agr. et Vitic. (Ed. l'Est-Centre)*, 42 (1921), No. 30, pp. 77-82).—These notes contain current information regarding grape chlorosis, downy mildew in Algeria, conservation of copper acetate, court-noué in Rhénanie, and injury to vines by freeze and hail.

New remedies for grape downy mildew (*Prog. Agr. et Vitic. (Ed. l'Est-Centre)*, 42 (1921), No. 15, pp. 350-355).—A note by Villedieu is referred to as denying that appreciable fungicidal action is produced by copper, and affirming that alkalis, notably lime, are effective in this regard. A formula proposed employs lime at 6 per cent and aluminum sulphate at 1.5 per cent, the preparation being carried out as with Bordeaux mixture.

H. Tudor is convinced that the efficacy of Bordeaux mixture is due to the drying effect of the lime, which should be somewhat in excess, say 5:4, of the copper salt.

Banana wilt in the Philippines, H. A. LEE and F. B. SERRANO (*Philippine Agr. Rev.*, 13 (1920), No. 2, pp. 128, 129).—Plants of the Latundan variety of banana (*Musa sapientum*) have been observed to be affected with banana wilt at Los Banos and Calamba in Laguna Province, and at San Luis, Lemery, and Taal in Batangas Province. Referring to reported appearances of this dis-

ease in places widely separated and in particular to the account by Brandes (E. S. R., 43, p. 848), the author states that the study in the Philippines has uniformly isolated a *Fusarium*, agreeing closely with the description of *F. cubense* and reproducing the disease symptoms after inoculation.

The Latundan is the only variety yet found to be susceptible, other varieties equally desirable appearing to be resistant. Results from inoculations with *F. cubense* upon the abaca plants, which were thought to be susceptible, appear to indicate that abaca is resistant to this disease.

The root disease of the banana in North Queensland, J. F. ILLINGWORTH (*Queensland Agr. Jour.*, 14 (1920), No. 6, pp. 297-301, figs. 5).—A disease of banana in the Cairns district, affecting the roots to such an extent that the plants sometimes fall to the ground for lack of anchorage, was found to be due to a nematode, supposedly *Tylenchus* sp. Suggestions looking to its control include the use of corrosive sublimate, arsenic, and lime.

Citrus diseases of the Philippines, southern China, Indo-China, and Siam, O. A. REINKING (*Philippine Agr.*, 9 (1921), No. 6-7, pp. 121-179, pls. 14).—A study of citrus diseases in southern China, Indo-China, and Siam was made by the author in collaboration with the Division of Crop Physiology and Breeding Investigations of the Bureau of Plant Industry, U. S. D. A., and a part of the results of this work has been published (E. S. R., 45, p. 647). The present discussion is limited to the citrus diseases found in the Philippines, southern China, Indo-China, and Siam. The work is divided into six main sections, one for each region, one for control measures, and a summary compiled on the basis of the hosts. A description of the diseases, a discussion of the causal organism, and suggestions regarding control measures proper to each are given. As a large number of fungi are parasitic on scales, a list of these collected in each country is given. The accounts of diseases found in the Philippine Islands and southern China, published in 1918-19, were revised, and with corrections and additions are embodied in the present article.

Commercial control of citrus scab, J. R. WINSTON (*U. S. Dept. Agr., Dept. Circ.* 215 (1922), pp. 8).—Practical directions are given for the commercial control of citrus scab. This disease, which is usually attributed to *Cladosporium citri*, has been investigated, and the author reports that *C. citri* is not the cause of the disease, that fungus having been confused in the identification of the causal organism. The fungus was not found to live over winter on mature fruit, but it passes this period on affected leaves. Cumulative evidence has been obtained which shows that citrus scab can be controlled satisfactorily and economically by the use of Bordeaux mixture or Bordeaux oil emulsion, either of which is very effective against scab in the nursery or in the orchard. Burgundy mixture is said to be less effective than Bordeaux mixture, and ammoniacal copper-carbonate solution and lime-sulphur solution are much less effective.

Detailed directions are given for the preparation of fungicides, and spray calendars are presented for the application of the different treatments suggested.

Experiments for the control of *Armillaria mellea*, W. A. BIRMINGHAM and W. B. STOKES (*Agr. Gaz. N. S. Wales*, 32 (1921), No. 9, pp. 649, 650).—Experimentation testing seven different treatments for control of *A. mellea* on roots of orange trees resulted in no important improvement.

[Brown bast and other diseases of *Hevea brasiliensis*] (*Nature [London]*, 107 (1921), No. 2694, p. 499).—In an account of the exhibits at the Fifth International Rubber Exhibition opened June 3, 1921, at the Royal Agricultural Hall, Islington, attention is called to the demonstration of the discovery by the botany department of the Imperial College of Science and Technology

that, in all probability, brown bast, said to be the most serious disease of *H. brasiliensis*, is essentially a question of phloem necrosis. It had been previously shown from the investigation of the anatomy of bur formation that the burs result from the inclusion of areas of diseased laticiferous tissue in stone cell pockets formed by the activities of wound cambiums. The recent work above referred to focuses attention, however, upon the probability that the disease has its origin in an affection of the sieve tubes (phloem), the symptoms previously described being a secondary development. Another series of preparations showed the wound-parasitic action of such fungi as *Diplodia*, *Nectria*, and *Fusarium*. It was further shown that rubber seed which had failed to germinate was also infected with *Diplodia*, previously known to cause a disease of *Hevea* seedlings.

Brown bast and the rubber plant, G. BRYCE (*Nature* [London], 108 (1921), No. 2707, pp. 81, 82).—Attention is called to alleged earlier statements than those above noted regarding the presence of latex vessels in the core of nodules. It is claimed, however, that nodule formation occurs in many cases other than those in which it is merely a secondary symptom of brown bast.

It is admitted that the occurrence of diseased sieve tubes in brown bast tissue, prior to the appearance of the disease in or adjacent to the latex vessels, has not been previously recorded. It is thought that if this is corroborated it may lead to further advance in our knowledge of this disease.

Investigations on brown bast, P. E. KEUCHENIUS (*Arch. Rubbercult. Nederland. Indië*, 4 (1920), No. 1, pp. 1-4).—Tabulation and discussion of experimental evidences support the infection as opposed to the physiological view in regard to the causation of *Hevea* brown bast, tissues affected with this disease yielding bacteria after being sterilized externally.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

The age of insects, Z. P. METCALF (*Jour. Elisha Mitchell Sci. Soc.*, 37 (1921), No. 1-2, pp. 19-53).—Included in this paper are discussions of the number of insects in the world, insect physiology, insect psychology, life histories, loss occasioned, benefits incurred, and ecological relations. It is estimated that in the year 1920 a loss of \$84,750,000 was caused by insects to farm and forest crops and products in North Carolina.

Insect pests (*South Carolina Sta. Rpt. 1921*, pp. 29-36, figs. 2).—This is a brief statement of the work under way with wireworms, the red spider, cotton or corn root aphid, boll weevil, peach-tree borer, etc., and investigations of temperature and moisture in relation to insect activity.

In the study of the life history and habits of the cotton-root aphid the manner in which ants transfer the aphids to the roots of certain winter food plants, such as life-everlasting or "rabbit tobacco," was worked out. The results of these observations of the seasonal food plants are reported in diagrammatic form. Applying these studies to farm practice, it was found that a successful winter cover crop eliminated the winter food plants from the cotton fields and greatly delayed spring recolonization, which, supplemented by frequent early shallow cultivation, reduced the losses from this pest to insignificance.

The temperature and moisture investigations indicate that successful hibernation depends on the ability of the insect to lose a certain percentage of its body weight, ranging from 26 to 33 per cent. In hibernation studies of the boll weevil 12 per cent of a total of 10,000 weevils placed in cages emerged in the spring of 1921, or the largest percentage known to successfully pass the winter. This was due to the unusually mild weather during the winter.

[Insect pests in Guam], G. BRIGGS (*Guam Sta. Rpt. 1920, pp. 39, 40, 61, 62*).—The leaf folder *Marasmia trapezalis* is destructive to corn through feeding upon the young leaves and appears to be present throughout the year. The European corn borer, apparently the insect referred to by Fullaway in the report of 1911 (E. S. R., 28, p. 158) as *Pyrausta vastatrix*, is present in large numbers on the island and also attacks grain sorghum, rice, and other plants. It is estimated that fully 50 per cent of the corn crop between the Ylig River and Piti was damaged by it in September, 1919, but the crop which followed during the dry season was not damaged as much. The corn aphid, *Aphis maidis*, badly damages the plants at times, and leaf hoppers are commonly found on young corn.

The injury to rice by the rice bug (*Leptocorisa varicornis*) was lessened by early planting, and in some cases by clean cultivation in the field surrounding the paddies. A borer, thought to be the sugar-cane borer *Rhabdocnemis obscurus* was discovered in the north and east sides of the island, where it appears to have been present for some time. A large green walking stick is a source of damage to coconut, the leaflets in some instances being so severely damaged that only the midrib remains.

Reference is made to injury by *Aspidiotus destructor* to coconut in Saipan, and a memorandum by H. E. Crampton, who visited that island toward the close of the fiscal year, is presented. From the memorandum it appears that this scale insect reached great proportions in Saipan, probably having been introduced from Yap, and by 1916 about 70 per cent of the trees had been killed. Conditions have since considerably improved. Precautions are being taken to prevent its introduction into Guam.

[Report on the] entomological branch, S. F. TOLMIE (*Canada Min. Agr. Rpt., 1920, pp. 105-108*).—This is a statement of work conducted by the entomological branch during the year.

[Report of the] division of entomology, C. P. LOUNSBURY (*Union So. Africa Dept. Agr. Rpt. 1919-20, pp. 35-38*).—This is a brief résumé of the work of the division of entomology during the year 1919-20.

Work of the division of entomology, E. JARVIS (*Queensland Bur. Sugar Expt. Stas. Ann. Rpt., 21 (1921), pp. 43-46*).—This is a report of work conducted with insect enemies of sugar cane.

Some insect problems confronting the avocado grower, G. F. MOZNETTE (*Jour. Econ. Ent., 14 (1921), No. 4, pp. 341-344*).—This is a discussion of the avocado insect problems met with in work in Florida. Accounts of insect enemies of this fruit by the author have been noted from other sources (E. S. R., 46, pp. 351 and 458).

Important insects collected on imported nursery stock in 1920, E. R. SASSCER (*Jour. Econ. Ent., 14 (1921), No. 4, pp. 353-355*).—This is a summary of information on the more important insects collected on imported stock during the year 1920.

Some notes on a new and promising insecticide, E. N. CORY (*Jour. Econ. Ent., 14 (1921), No. 4, pp. 345-347*).—The alcoholic extract of pyrethrum when prepared in the form of a heavy liquid soap mixes readily with water at any desired strength, spreads evenly, and sticks fairly well. The work reported, in which a number of different insects were used, indicates that it has a decided effect as a contact insecticide, repelling powers to a considerable degree, and a possibly toxic action. The field for the use of this material in greenhouses on flowers and ornamentals and in home gardens seems to be promising.

Locust control, E. R. BUCKELL (*Brit. Columbia Dept. Agr., Hort. Branch Circ. 63 (1921), pp. 12, figs. 8*).—This is a popular summary of information.

Controlling tipburn or hopperburn of potatoes, T. H. PARKS and E. E. CLAYTON (*Ohio Sta. Mo. Bul.*, 6 (1921), No. 11-12, pp. 168-171, fig. 1).—This is a brief account of the potato leaf hopper and the injury caused by it, with a report of spraying demonstrations.

Field work was planned and carried out in nine counties with the assistance of the county agents, 33 farmers spraying on schedule and keeping yield records. Out of 53 separate spraying demonstrations, in which homemade Bordeaux mixture 5:5:50 was used, in only two cases did the sprayed plats fail to yield more than the unsprayed. Many of the increases were from 30 to 35 bu., and in one case the sprayed field yielded at the rate of 82 bu. to the acre more than the unsprayed, or an increase in yield of 76 per cent. Surprisingly good results were secured with only two or three applications of spray where these applications were very thorough. The dusting results were not nearly so good nor so consistent as those secured with liquid spraying.

Of the early varieties, Early Triumph proved to be the most susceptible to hopperburn, even the sprayed rows succumbing early, and it is doubtful if this variety can be profitably grown during the years when leaf hoppers are numerous. Early Ohio was quite susceptible, but it gave good results in favor of the spraying. Irish Cobbler was the least susceptible of the early varieties. Of the late varieties, Rural New Yorker showed marked susceptibility, while the Russet Rurals were more resistant. Varieties of the Green Mountain type seemed to endure the trouble still better, remaining green when other sorts were brown and dead. Fourteen varieties were tested, the spraying having paid well on all except Early Triumph.

Biological control of the black scale (*Saissetia oleae* Bern.) in California, H. S. SMITH (*Jour. Econ. Ent.*, 14 (1921), No. 4, pp. 348-350).—It is pointed out that *Aphycus lounsburyi*, which was colonized on infested trees on the Limoneira ranch at Santa Paula in Ventura County, increased sufficiently from September so that by May of the following year the trees were commercially free of scale. The work has progressed to a point where it is safe to conclude that this parasite will be of immense practical value in control of the black scale. Secondary parasites, however, have increased enormously since the introduction of *Aphycus*.

Late-feeding larvae injurious to apple in Pennsylvania, including several new injurious species, S. W. FROST (*Jour. Econ. Ent.*, 14 (1921), No. 4, pp. 324-328, figs. 2).—The control of various late-feeding lepidopterous larvae which mar the fruit of apple is one of the most serious problems confronting fruit growers in Pennsylvania. These late-feeding larvae may be divided into three general classes, namely, the leaf-rollers, bud moths, and codling moth, together with other similar feeders. The leaf-roller group, which produces large and sometimes deep cavities, includes the oblique-banded leaf-roller (*Archips rosaceana* Har.); the red-banded leaf-roller (*Eulia velutinana* Wlk.), a new and exceedingly abundant and injurious species; and *Amorbia humerosana* Clem., another new apple pest. The bud moths responsible for the late scars and blemishes on the fruit include the eye-spotted bud moth (*Tmetocera ocellana* Schiff.) and a new species, *Sparganothis idaeusalis* Wlk., both of which are abundant and injurious. The smaller late side feeders of apple include the codling moth, the lesser apple worm, and the lesser bud moth (*Recurvaria nanella* Hübn.). Control experiments clearly demonstrate that injuries from these late summer feeding lepidopterans can be materially reduced if orchardists practice consistent and thorough spraying during the early spring months.

Studies of *Sanninoidea opalescens* Edw. in Oregon, F. H. LATHROP and A. B. BLACK (*Jour. Econ. Ent.*, 14 (1921), No. 4, pp. 328-336).—This is a report

of an investigation of the biology and control of the western peach and prune root borer commenced by the Oregon Experiment Station in 1916 with the view to discovering an effective and economical means of control. The control work was directed at the application of some substance during the fall or winter that would destroy the larvae in their winter cells. Miscible oil-sodium arsenate sprays, whitewash, and fuller's earth-molasses wash were tested, and quite satisfactory results were obtained from the application of fuller's earth-molasses wash containing naphthalene.

Parasitism and nicotine in the control of the oriental peach moth: A second report, L. A. STEARNS (*Jour. Econ. Ent.*, 14 (1921), No. 4, pp. 336-341).—This is a further report of studies of *Laspeyresia molesta* Busck in Virginia (E. S. R., 43, p. 558; 46, p. 659), its life history and experimental control, including laboratory tests with nicotine. The actual percentages of efficiency for varying dilutions of nicotine sulphate, applied 1:1,600, 1:800, and 1:500, were 3.8, 60.4, and 73.5, respectively. The addition of a spreader influenced the effectiveness of nicotine sulphate, especially in the case of a greater dilution. *Macrocentrus* sp. is said to have been at all times the most abundant parasite observed, it apparently becoming equally brooded with the peach moth.

The European corn borer: Quarantine regulations for infested Ohio areas, E. C. COTTON (*Ohio Sta. Mo. Bul.*, 6 (1921), No. 11-12, pp. 180-186, figs. 4).—This is a summary of information on the European corn borer, which appears to have spread from the infestation in Canada and now infests all of the counties in Pennsylvania, Ohio, and Michigan bordering upon Lake Erie.

The tent caterpillar and the fall webworm, H. C. SEVERIN (*S. Dak. State Ent. Circ.* 23 (1921), pp. 10, figs. 4).—This is a general account of these two insect pests, which are serious enemies of fruit and shade trees, respectively, in South Dakota.

The juniper webworm, *Ypsolophus marginellus* Fab. (Lepid., Gelechiidae), H. B. WEISS and R. B. LOTT (*Ent. News*, 33 (1922), No. 3, pp. 80-82).—The authors present notes on this European species, first recorded in this country from New York State in 1910, and which has increased in several places in New Jersey during the past few years and is doing notable damage. The larval feeding appears to be confined to the foliage of *Juniperus communis* and several of its varieties.

Notes on the carpenter worm (*Prionoxystus robiniae* Peck) and a new method of control, H. E. BURKE (*Jour. Econ. Ent.*, 14 (1921), No. 4, pp. 369-372).—The lepidopteran here considered is one of the worst enemies of the native live oak (*Quercus agrifolia*) and the introduced elms (*Ulmus campestris* and varieties) in California.

Injury to structural timber by lepidopterous larvae, T. E. SNYDER (*Jour. Econ. Ent.*, 14 (1921), No. 4, pp. 366-369).

The seasonal abundance of the mosquito-destroying top-minnow, *Gambusia affinis*, especially in relation to fecundity, R. L. BARNEY and B. J. ANSON (*Anat. Rec.*, 22 (1921), No. 5, pp. 317-335, figs. 9).—This is a report of biological studies of this mosquito-destroying minnow conducted from the field laboratory at Mound, La., by the U. S. D. C. Bureau of Fisheries in cooperation with the U. S. D. A. Bureau of Entomology during the years 1916 to 1918 and in 1920.

Host records of some Texas Tachinidae, H. J. REINHARD (*Ent. News*, 33 (1922), No. 3, pp. 72, 73).—Host records of 16 species of Tachinidae based upon rearings are given in this paper.

Notes on the life history and the control methods of the boxwood leaf midge (*Monarthropalpus buxi* Labou.), C. C. HAMILTON (*Jour. Econ. Ent.*, 14 (1921), No. 4, pp. 359-365, pl. 1).—This is a report of studies at the Maryland

Experiment Station, where the adults were found to emerge from the middle of May to early in June. They are best controlled while the adult is emerging from the pupal skin.

"Spraying with molasses, diluted one part to three parts of water, gave the best results, entangling the majority of the adults as they emerged or before laying eggs. The under surface of the old and new leaves must be thoroughly covered with the molasses spray, and the spraying must be repeated often enough to keep them sticky. Laboratory experiments, spraying once with Blackleaf 40 and once with Blackleaf resinates diluted 1 part to 500 parts of water killed approximately 80 per cent of the adults before they emerged successfully. A killing effect was noted four and five days after spraying. Spraying should probably be repeated at intervals of not less than four or five days during the emerging period."

The biology of *Ephydra subopaca* Loew, C. PING (*New York Cornell Sta. Mem.* 49 (1921), pp. 561-616, figs. 45).—This is a report of observations and experiments commenced in the summer of 1916 and conducted for a period of two years at Ithaca, N. Y., where this dipteran occurs in salt pools.

The eggs are laid on the surface of the water and immediately sink to the bottom. They can hatch in salt, lake, or tap water, and at a temperature of 33° C. (91.4° F.) this takes place in 17 hours, while at a temperature of from 18 to 20° three days are required. The larva completes its development in from 11 to 13 days at a temperature of from 23 to 35°, it preferring to live in stagnant and shallow water containing salt ranging from 1 to 8 per cent, 4 to 5 per cent being the optimum. The pupal period lasts from 2 to 11 days in the laboratory and from 4 to 5 months in the field. The flies appear in May or June and prefer to stay on the surface of still water. The winter is usually passed in the larval and pupal stages, although a few adults may hibernate successfully.

A bibliography of four pages is included.

The Japanese beetle quarantine, C. W. STOCKWELL (*Jour. Econ. Ent.*, 14 (1921), No. 4, pp. 350-352).

Banana beetle borer investigations, J. L. FROGGATT (*Queensland Agr. Jour.*, 16 (1921), No. 3, pp. 200-208, figs. 4).—This is a first progress report on investigations of *Cosmopolites sordidus* Chev., recent accounts of which by W. W. Froggatt (*E. S. R.*, 42, p. 857) and Tryon (*E. S. R.*, 43, p. 457) in Australia, Mozzette in the United States (*E. S. R.*, 43, p. 560), and others have been noted.

Dispersion of the boll weevil in 1921, B. R. COAD, E. S. TUCKER, W. B. WILLIAMS, F. F. BONDY, and R. C. GAINES (*U. S. Dept. Agr., Dept. Circ.* 210 (1922), pp. 3, fig. 1).—The mild winter of 1920-21 and the wet summer were favorable to an abnormal multiplication of the boll weevil, which has now reached the limit of cotton cultivation except in western Texas, southwestern Oklahoma, northeastern North Carolina, and Virginia. The States of Missouri and Kentucky were invaded by the weevil for the first time. Extensive inspections failed to reveal any weevils in New Mexico, and the situation in Arizona remains the same as the preceding year except that specimens of the *Thurberia* weevil were found in a cotton field at Continental. Altogether 66,662 square miles of new territory were invaded by the weevil in 1921, and there was no loss of territory at any point.

The account is accompanied by a map showing the dispersion of the weevil in the United States from 1892 to 1921.

A cosmopolitan weevil in the West Indies (*Agr. News [Barbados]*, 21 (1922), No. 516, pp. 42, 43).—This is an account of the coffee bean weevil (*Aracocerus fasciculatus* De G.) as a source of damage to stored mace and nutmegs in Grenada.

The future of bee disease control, E. F. PHILLIPS (*Jour. Econ. Ent.*, 14 (1921), No. 4, 317-323).

Mermis parasitic on ants of the genus *Lasius*, W. C. CRAWLEY and H. A. BAYLIS (*Jour. Roy. Micros. Soc.*, No. 4 (1921), pp. 353-372, figs. 12).—The first part of this paper, which is by Crawley (pp. 353-364), reports upon the occurrence of a nematode parasite and its effect on the host. The second part consists of a description, by Baylis, of the nematode under the name of *M. myrmecophila* n. sp.

The introduction into New Zealand of *Aphelinus mali* Hald., a valuable parasite of the woolly aphis, R. J. TILLYARD (*New Zeal. Jour. Agr.*, 23 (1921), No. 1, pp. 7-19, figs. 6).—The author discusses the manner in which this parasite was introduced from the United States into New Zealand, where it appears to have become established. A short account of its life history is included.

Notes on the occurrence and distribution of Antarctic land arthropods (springtails and mites: Collembola and Acarina), H. E. EWING (*Ent. News*, 33 (1922), No. 3, pp. 76-79).

The red spider on the avocado, G. F. MOZNETTE (*U. S. Dept. Agr. Bul.* 1035 (1922), pp. 15, pl. 1, figs. 11).—This is a report of investigations of *Tetranychus yothersi* McG. conducted during the years 1918 and 1919, and the results of cooperative spraying experiments by the station of the Bureau of Entomology at Miami, Fla.

This pest, which is one of the most important enemies of the avocado, has caused a premature defoliation of the tree during the winter season. Such defoliation results in an abnormal development of the bloom the following spring, and the weakened trees are unable to set and hold a full crop of fruit. Originally described from specimens on camphor in Florida, it has been found by the author to attack both the West Indian and Guatemalan varieties of avocado, being particularly injurious to the more tender West Indian types, and it occasionally causes considerable injury to the mango and in many sections of northern Florida to the camphor and Australian silk oak. It has also been collected by the author from several other host plants and has been recorded by McGregor from several additional ones. Collection records indicate a wide distribution of the species throughout the South. Technical descriptions of its several stages are presented, together with notes on its biology.

The rainfall exerts a marked influence upon its development and activity. It barely maintains an existence during the rainy season, commencing in April, and no pronounced gain is made during the summer months, but by the latter part of October the avocado ceases to produce new growth and the red spiders commence to make their appearance in greater numbers during November and December. The maximum number are reached during January and February, decreasing again by March.

Several predatory insect enemies of this pest aid at various times to a small degree in preventing its increase, namely, *Scolothrips sexmaculatus* Perg., *Chrysopa lateralis* Guer., *Scymnus utilis* Horn., *S. kinzeli* Casey, and *Leptothrips mali* Hinds. Several insecticides were tested in control work with the pest. An impalpable sulphur dust applied with a power duster destroyed 99 per cent of the red spiders and remained effective on the foliage over as long a period as any of the liquid sprays tested, but the presence of other insect pests make it necessary to use liquid insecticides. Lime-sulphur concentrate was found to be effective when applied at the rate of 1 gal. to 60 gal. of water, usually killing 99 per cent of the red spiders and producing sufficient body as a spray on the foliage to remain effective during the dry season against later hatching young. Under certain conditions this strength caused considerable burning, and when the temperature is above normal during the winter season

or when the trees do not attain a thoroughly dormant condition a strength of 1:75 was found satisfactory. Commercial sodium sulphid at a strength of 2 lbs. to 50 gal. of water killed approximately 95 per cent of the red spiders present. The red spiders which made their appearance during the fall before the fruit was picked were satisfactorily destroyed by the use of 40 per cent nicotin sulphate at the rate of 1 part to 900 parts of water with the addition of 2 or 3 lbs. of fish-oil soap to each 100 gal. of the diluted spray. The spray gun gave better satisfaction than did the spray rod.

The European red mite (*Paratetranychus pilosus* C. and F.) in Connecticut, P. GARMAN (*Jour. Econ. Ent.*, 14 (1921), No. 4, pp. 355-358, fig. 1).—A brief account of *P. pilosus*, which appeared during the summer of 1920 in destructive numbers in Connecticut orchards.

FOODS—HUMAN NUTRITION.

Studies upon the toxicity of putrid food, W. G. SAVAGE (*Jour. Hyg. [Cambridge]*, 20 (1921), No. 1, pp. 69-84).—In introducing the experimental work reported in this paper, the author points out three fallacies upon which the theory of the harmfulness of incipiently putrefactive food has been based. These are the failure to attribute the harmfulness of such meat or other foodstuff to specifically harmful bacteria with which the foodstuff is usually infected, the use in chemical studies of the end products of putrefaction and not of the products in the state in which there is a possibility of their being consumed, and the testing for toxicity of food materials by injection into the experimental animals instead of by feeding. In the experiments reported rabbits and kittens were fed putrid meat extracts, some of which contained bacteria and some of which did not, and these materials were also injected either subcutaneously or intraperitoneally. In general the injection of the putrid material proved fatal, while feeding material which did not contain bacteria produced no other untoward symptoms than some loss of appetite and weight.

In conclusion, it is emphasized that these animal experiments do not suggest that food in a putrefying condition is harmless and can be neglected, but call attention to the absence of positive data incriminating putrefactive food as a cause of definite illness. "Harmfulness from bad food is a matter of specific infection with particular pathogenic bacteria in all or almost all cases."

Studies on the detection of incipient spoilage in meat, J. TILLMANS, R. STROHECKER, and W. SCHÜLTZE (*Ztschr. Untersuch. Nahr. u. Genussmtl.*, 42 (1921), No. 3-4, pp. 65-75).—On the assumption that meat in the state of incipient spoilage is infected with bacteria of different biological properties, three tests for the detection of such bacteria are recommended. The first test is a slight modification of the method suggested by Tillmans and Mildner,⁴ which assumes that if a water suspension of finely ground meat is kept at a temperature favorable for bacterial growth the presence of bacteria can be detected by determination of the dissolved oxygen remaining in the water after a definite length of time. This method is open to criticism in that it takes into consideration only aerobic organisms. To cover other possibilities two other methods are suggested, these detecting bacteria which reduce nitrates and decolorize methylene blue, respectively. Each of these methods is described in detail.

The sources and characteristics of the bacteria in decomposing salmon, A. C. HUNTER (*Jour. Bact.*, 7 (1922), No. 1, pp. 85-109, fig. 1).—Continuing the investigation of the bacterial decomposition of salmon (*E. S. R.*, 44, p. 556), the

⁴ *Ztschr. Untersuch. Nahr. u. Genussmtl.*, 32 (1916), No. 2, pp. 65-75.

author has made a study of 316 cultures collected from sea water, from decomposing salmon, and from salmon canneries throughout southeastern Alaska. By the elimination of duplicates this number was reduced to 85 cultures, including an *Actinomyces*, a pink yeast, and four white yeasts. Of the remaining cultures 72 were rod-shaped organisms without spores, 3 were spore-forming rods, and 4 were streptococci. The morphology and cultural reactions of these organisms are tabulated. The majority appear to belong to a large group of non-fermenting soil and water bacteria. *Pseudomonas fluorescens*, *Bacterium cloacae*, and an unidentified flesh-colored organism are considered to play the most important part in the decomposition of salmon.

The results of this investigation are considered to confirm the statement previously made that "the bacteria concerned in the decomposition of salmon are those forms the natural habitat of which is the sea water from which the salmon are taken, and that the decomposition of salmon is not due to bacteria which contaminate the salmon within the cannery."

Viability of the colon-typhoid group in carbonated water and carbonated beverages, S. A. KOSER and W. W. SKINNER (*Jour. Bact.*, 7 (1922), No. 1, pp. 111-121).—A study is reported from the Bureau of Chemistry, U. S. D. A., of the viability of the colon-typhoid group in different types of commercial carbonated beverages. The period of viability of these bacteria in carbonated water was much shorter than in tap water and also in acid than in nonacid beverages. Colorimetric H-ion concentration determinations of carbonated water have given pH values of 4 to 4.4, the release of pressure being followed by very little if any immediate change in H-ion concentration. It is considered that the death of the bacteria in carbonated water and in acid beverages is due to the acidity of the liquid.

Bacterium taphosum and *B. paratyphosum* B proved to be more readily destroyed than *B. coli*. The spore forms of *B. mesentericus* and of *Clostridium sporogenes* were found to be quite resistant to carbonation.

"It must be stated emphatically that the results obtained in this investigation do not warrant the conclusion that water of a low sanitary quality can be used by the industry in the preparation of carbonated beverages, or that carbonation can be relied upon to destroy evidence of pollution. In many instances, particularly during the summer months, beverages are consumed within a few hours after their preparation, and it is obvious that under these conditions pathogenic organisms, if originally present in the water, may survive carbonation and reach the consumer."

Sterilization of corn and tomatoes, W. D. BIGELOW (*Canner*, 54 (1922), No. 3, pp. 31-34).—In this paper the author discusses various factors which must be considered in the canning of corn and tomatoes on a large scale.

It is emphasized that the bacteria causing the spoilage of canned corn may be divided into two classes according to the heat required for their sterilization, and that if the corn can be processed at such a temperature as to destroy the heat-resistant bacteria, subsequently cooled to a temperature below 100° F., and kept at that temperature it will not spoil, at least within a period of two or three years. The difficulty in fulfilling such conditions is shown to be due largely to the difficulty in controlling the cooling operation and to the lack of uniformity in the process required for the sterilization of different cans, even in the same pack. Four factors of fundamental importance in processing are emphasized especially. These are the initial temperature of the corn, the accuracy with which the retort temperature is controlled, the time occupied in heating the retort, and the efficiency of cooling after processing.

With tomatoes, although the time and temperature of processing need not be as great as with corn, the same factors, particularly the high initial tem-

perature, should be considered. Data on the time and temperature of processing both corn and tomatoes in the different sized commercial cans are included.

Crystallized fruits, [J. A. SHARWOOD] (*Table and Housekeepers' Jour.*, 70 (1922), No. 1813, p. 261).—A concise summary of information.

Experiments in the manufacture of fruit butters, J. H. IRISH (*Canner*, 54 (1922), No. 4, pp. 27, 28).—Directions are given for the preparation on a large scale of prune butter and pear spread.

Interesting substitutes for food products, A. VIEHOEVER (*Amer. Food Jour.*, 17 (1922), No. 1, pp. 21-24, figs. 10).—This contribution from the Bureau of Chemistry, U. S. D. A., describes several little-known food and drug plants which are thought to offer possibilities as substitutes for well-known products, and the characteristics of which should be known by food officials. The products described include zamia and its starch; tepary bean, a plant closely related to the common bean and to the Lima bean; robusta coffee; the fruit of *Solanum macrocarpum*, a possible substitute for tomatoes; African sorrel, a product which may be used as a substitute for spinach; cassina, a product which may attain importance as a drink taking the place of tea or coffee; Spanish thyme; several cubeb substitutes; and twin leaf, a substitute for goldenseal.

The energy value of foods determined by combustion and by calculation, J. KÖNIG and I. SCHNEIDERWIRTH (*Chem. Ztg.*, 45 (1921), No. 109, pp. 873, 874).—Attention is called to various sources of error involved in the computation of the caloric value of foods from the percentage composition of crude protein, fat, and carbohydrate, and data are reported showing the actual differences in caloric value of 24 typical foods as determined by calculation and by combustion in the bomb calorimeter.

Sufficiently close agreement was found in the case of milk, eggs, butter, and cheese, and of potatoes, beets, dried vegetables, and white bread. Meat and fish in general gave higher results for the calculated values than by direct combustion, and green vegetables such as spinach, asparagus, cabbage, and cauliflower higher for the combustion than for the calculated values. In discussing these results, the authors conclude that it is sufficiently accurate to determine the energy value by calculation, inasmuch as in a mixed diet consisting of animal and vegetable materials the errors are more or less compensatory.

On the law of surface area in energy metabolism, J. R. MURLIN (*Science*, n. ser., 54 (1921), No. 1392, pp. 196-200).—In this discussion of the applicability of the Rubner-Richet law of surface area in energy metabolism, the author takes exception to the criticisms of Harris and Benedict (*E. S. R.*, 41, p. 760) and Benedict and Talbot (*E. S. R.*, 45, p. 561) that surface area is little or no better as a measure of metabolism than is body weight. He presents data to show that, while surface is no better than weight as a measure of metabolism in individuals of nearly the same weight, it is a much more accurate measure in the case of individuals with considerable variation in weight. Statements of Rubner and of Richet are quoted, indicating certain reservations in the application of the law of surface areas.

The coefficients of variability and of correlation for the minimal metabolism of newborn infants according to the data of Talbot (*E. S. R.*, 42, p. 168) and Benedict (*E. S. R.*, 43, p. 166) have been calculated, using four different formulas for surface—the Meeh-Rubner, Lissauer, Howland and Dana, and DuBois formulas. These show that "heat production as determined by Benedict and Talbot is more variable than either body weight or body surface, no matter by which formula it is measured; and that it makes very little difference which formula is used for body surface so far as correlation with heat production is concerned. The formula of Howland and Dana gives the most variable body

surface; the height-weight formula of DuBois, which has never been confirmed for infants, gives the least variable. But the formula of Lissauer gives a body surface which parallels the metabolism slightly better than the others, the difference, however, being altogether negligible. Taking the entire group of newborns in this series we may conclude that the sleeping metabolism, which is practically the whole of metabolism in the newborn, is as well measured by one formula as another; also that surface by any formula is but slightly better than body weight as a measure."

In conclusion the author states that it is necessary to distinguish clearly the arguments against the law of surface as of two classes: (1) On the basis of fact and (2) on the basis of explanation. The former arguments are thought to have been misconceived and the latter to be unnecessary to the application of the law.

The human body as a working mechanism (*Jour. Amer. Med. Assoc.*, 77 (1921), No. 26, pp. 2062, 2063).—An editorial discussion based on a summary of data.

The law of the minimum in the science of nutrition, K. THOMAS (*Ztschr. Angew. Chem.*, 34 (1921), No. 97, *Aufsatz.*, pp. 601-606).—In this lecture the author traces the changing views on nutrition of the last few years and emphasizes particularly the significance in nutrition of the law of the minimum. Milk is selected as the best example of a food, the value of which has been attributed to different factors in the different periods of nutritional knowledge, but which, in the light of present knowledge, is seen to owe its value to its ideal composition in the kind and proportion of the amino acids of its protein, and in its content of mineral matter and of vitamins.

As an illustration of the application of the law of the minimum attention is called to the low content of iron in milk, and an experiment reported several years ago by Schmidt is recalled in which several generations of mice were raised on a diet of white rice and fresh milk. While the animals of the first generation were very anemic, due to the deficit of iron in the food, those of the succeeding generations were less anemic, but were also of much smaller size, thus showing a gradual adaptation to the iron content of the food as the minimum upon which the nutrition as a whole depended.

The food requirements of children.—II, Protein requirement, L. E. HOLT and H. L. FALES (*Amer. Jour. Diseases Children*, 22 (1921), No. 4, pp. 371-380, figs. 3).—This paper discusses the protein requirements of children as reported in the literature and as indicated by the protein consumption of the 100 children who were subjects in the dietary studies reported in the previous paper (*E. S. R.*, 45, p. 162).

The average amount of protein taken in the usual mixed diet of these children ranged from 44 gm. daily in the second year to 130 gm. in the fifteenth year. Calculated per kilogram of body weight, the protein averaged about 4 gm. at one year, diminished to about 2.6 gm. at six years, and remained at this value until the end of growth. About two-thirds of the protein taken by these children was in the form of animal protein and about one-third of vegetable protein, the proportion not varying to any extent with the age of the child. The superior value of animal to vegetable protein is emphasized in the authors' discussion.

The basal metabolism of infants fed on dry milk powder, F. B. TALBOT and M. E. MORIARTY (*Pub. Health Rpts. [U. S.]*, 37 (1922), No. 3, pp. 116-123, figs. 8).—As a part of an investigation on the use of dry milk powder in infant feeding, a preliminary report of which by Price has been previously noted (*E. S. R.*, 43, p. 566), basal metabolism determinations on 12 normal infants (5 boys and 7 girls) fed on dry milk powder prepared as described in the above-

noted paper were made at the Massachusetts General Hospital according to the usual technique.

Charts are given showing the distribution of the cases as compared with the normal standards of total calories referred to age and to weight, and of calories per kilogram of body weight and per square meter of body surface referred to age. These charts show a tendency for the boys to fall within or very close to the standard variations, while the metabolism of the girls ran higher and, with few exceptions, was more than 10 per cent above the average. It is pointed out that this difference in metabolism is in agreement with the previous observations of Benedict and Talbot (*E. S. R.*, 45, p. 561) that it is much more difficult to predict the metabolism of female than of male infants, and that the deviation from the average is much greater in the former than in the latter.

In general, the basal metabolism of this series of infants was slightly higher than that of average normal infants, but was within normal limits.

Diet and sex as factors in the creatinuria of man, G. STEARNS and H. B. LEWIS (*Amer. Jour. Physiol.*, 56 (1921), No. 1, pp. 60-71).—The experiments reported in this paper were undertaken to furnish additional evidence on certain points concerning creatin excretion in women, (1) the relation of creatinuria to the sexual cycle in the normal adult female, (2) the influence of the protein content of the diet on the creatinuria of women, and (3) the ability of the female organism to destroy ingested creatin.

The three women who served as subjects were all maintained on a creatin-creatinin free diet during the periods of study. The low protein diet consisted chiefly of potatoes supplemented by bread, butter, fruit, and green vegetables, and the high protein diets first of eggs, beans, and bread and later of the commercial diabetic food glidine supplemented by legumes and cheese.

Data on the first point covered eight complete menstrual periods with fore and after periods. In no case was a tendency toward creatinuria more marked during or near the period of menstruation than at any other time, findings in harmony with the conclusions of M. S. Rose (*E. S. R.*, 39, p. 873), W. C. Rose et al. (*E. S. R.*, 39, p. 571), and of the recently reported work of Wang and Dentler (*E. S. R.*, 45, p. 162). Similar results were obtained in regard to protein. No evidence was obtained that protein in itself was the causal factor in the production of creatinuria either in the menstrual or intramenstrual periods.

The results of creatin ingestion were in general similar to those previously reported by other authors for men subjects. With one exception creatin administration in amounts up to 2 gm. resulted in slight creatinuria only.

In seeking a possible cause for the excretion of creatin by women, attention is called to the fact that in the earlier experiments, in which both subjects were in poor physical condition, creatin occurred more frequently than in the later experiments, in which the subjects were in better physical condition. "It would be of interest to compare the creatin excretion of healthy women who lead an outdoor life with that of women who work indoors under high nervous tension."

The influence of food ingestion upon endogenous purin metabolism, I, II, W. C. ROSE (*Jour. Biol. Chem.*, 48 (1921), No. 2, pp. 563-590, fig. 1).—In the first of the two papers presented the author discusses the various theories which have been advanced to explain the influence of food ingestion upon endogenous purin metabolism. In the second he presents the results of an investigation conducted at intervals during the past five years, with the assistance of J. S. Dimmitt and H. L. Bartlett, on the endogenous purin metabolism of four sub-

jects on various diets, the plan of the investigation being similar to that of the previously reported creatin and creatinin studies (E. S. R., 39, p. 571).

From the experimental data reported and the critical survey of the literature on the subject, the author concludes that "endogenous purins have their ultimate origin in arginin and histidin, but that the extent of their synthesis is limited quantitatively to the anabolic needs of the organism. Superfluous molecules of arginin and histidin, which are not required for anabolism, are probably, in the adult at least, oxidized without preliminary transformation into purins. Under conditions of constant diet and nitrogen equilibrium, purin metabolism, as measured by the uric acid output, proceeds at a fairly constant rate, but this rate may be altered by changes in the character or quantity of food ingested. Amino acids and probably digestive (or metabolic) products of carbohydrates and fats exert a general stimulating action upon cellular catabolism, which is manifested by a rise in uric acid elimination following marked increases in food consumption. Moreover, indirect evidence indicates that perhaps in the case of the amino acids they themselves, rather than their nitrogen-free derivatives, are the stimulating agents. It is suggested that when the organism is deprived of purin precursors, an additional factor leading to variations in uric acid excretion may be a reutilization for anabolic purposes of part of the purins liberated in catabolism."

Colorimetric studies of tryptophan.—VI, The tryptophan content of some foods and the tryptophan requirement of adults, O. FÜRTH and F. LIEBEN (*Biochem. Ztschr.*, 122 (1921), No. 1-4, pp. 58-85).—Determinations of the tryptophan content of various animal and vegetable foods by the method noted in a previous paper (E. S. R., 45, p. 311) are reported, and the results are utilized to estimate the tryptophan requirement of adults under varying conditions, as determined from the protein content of various dietaries reported in the literature.

The tryptophan content of the foods studied, expressed in percentage of the protein content of the food, varied from 1.55 per cent in the case of shell fish to 3.3 per cent in cabbage and potatoes and 4.3 per cent in spinach. It is estimated that on an ordinary mixed diet the tryptophan would represent between 2 and 2.4 per cent of the protein of the diet.

Calculations of the tryptophan content of the diets used in 32 metabolism studies, as reported in the literature, showed that for an individual of 70 kg. body weight on a mixed diet the tryptophan would vary from 2.5 to 3.2 gm., or from 0.036 to 0.046 gm. per kilogram of body weight per day. The tryptophan content of the food can be lowered to a value of from 0.017 to 0.02 gm. per kilogram per day without harm, but how long the organism can continue to subsist on so small a tryptophan allowance has not been determined.

Do we digest all fats equally well? J. J. WILLAMAN (*Amer. Food Jour.*, 17 (1922), No. 1, pp. 15, 16).—This is a summary of the results obtained in the entire series of studies on the digestibility of fats conducted at the Office of Home Economics, U. S. D. A., and which have been previously noted from their original sources (E. S. R., 45, p. 62).

Studies in nutrition.—The choice between adequate and inadequate diet, as made by rats and mice, H. S. MITCHELL and L. B. MENDEL (*Amer. Jour. Physiol.*, 58 (1921), No. 2, pp. 211-225, figs. 24).—Observations by Osborne and Mendel on the choice between adequate and inadequate diet, as made by rats (E. S. R., 39, p. 770), have been extended to include a wider variety of choice and with mice as well as rats as the experimental animals. The types of choice offered in the form of "synthetic" paste foods included food mixtures with a high and low content of protein, complete and incomplete protein, and high and low content of vitamin A, vitamin B, and inorganic salts, respectively.

Out of many trials two mice alone represented the only exceptions to advantageous selections in the choice of diets by either rats or mice. These two exceptions were on the complete and incomplete protein (casein and zein). Of the three mice on this diet, one alone selected sufficient casein to prevent nutritive decline. The tests in which protein-free milk was used as the source of vitamin B were complicated by the fact that the granular consistency of the protein-free milk tended to produce diarrhea when taken in sufficient amounts. The animals ate some of this diet and some of the inferior food, but were unable to maintain a normal rate of growth. When the inferior food was finally supplemented by the addition of a small amount of yeast, the animals took this in preference to the food containing protein-free milk and began to gain in weight.

The natural foods used consisted of ground whole corn, dry meat meal, and salt mixture, the rats being offered a choice between the corn and the meat meal. In the case of two young rats the actual proportion of meat eaten was small, yet was sufficient to supplement the corn ration so as to promote normal growth, while in contrast a rat fed on corn alone grew less well, although attempting to acquire the necessary amount of protein by an enormous food intake. The protein in the ration chosen constituted 12 and 19 per cent respectively, while in the case of two older rats the protein represented 20 and 25 per cent, respectively, of the total caloric value of the food. It is interesting to note that the younger animals selected a smaller proportion of protein than the older ones, but that none of them chose an excessively high protein diet.

These results are thought to confirm the earlier conclusions that in their choice of foods rats and mice make selections which are advantageous for their nutritive condition.

Vitamin requirements of certain yeasts and bacteria, C. FUNK and H. E. DUBIN (*Jour. Biol. Chem.*, 48 (1921), No. 2, pp. 437-443).—The authors claim to have separated from extracts of autolyzed yeast, by two successive shakings with 100 gm. of fuller's earth or Norit per liter of the extract, a substance which is thought to be a definite and specific growth stimulant for yeast and possibly for other bacteria. This has been provisionally named vitamin D.

The effect of certain stimulating substances on the invertase activity of yeast, E. W. MILLER (*Jour. Biol. Chem.*, 48 (1921), No. 2, pp. 329-346).—An investigation originally undertaken to obtain further information concerning the effect of yeast extract on the enzymes of yeast has led to the partial separation from the water or alcohol extract of yeast of two substances, one of which contains the growth-promoting vitamin B and the other an apparently different substance which accelerates the rates of invertase formation in yeast. The separation has been accomplished in three ways: (1) By extraction of the growth stimulant with benzene, (2) by adsorption with fuller's earth, and (3) by precipitation with phosphotungstic acid. The substance which accelerates invertase formation was found in high concentration in the gummy precipitate separating from the hot alcohol extract of yeast. This is thought to suggest the possibility that the substance is some form of carbohydrate.

The nutritive value of yeast in bread, P. B. HAWK, C. A. SMITH, and O. BERGEIM (*Amer. Jour. Physiol.*, 56 (1921), No. 1, pp. 33-39, figs. 7).—Essentially noted from a preliminary report (E. S. R., 45, p. 566).

Can yeast be used as a source of the antineuritic vitamin in infant feeding? A. L. DANIELS (*Amer. Jour. Diseases Children*, 23 (1922), No. 1, pp. 41-50, figs. 8).—Attempts to use yeast in place of wheat embryo extract, previously recommended by Daniels, Byfield, and Loughlin (E. S. R., 42, p. 256), or pancreas extract, as recommended by Eddy (E. S. R., 37, p. 65), as a growth stimulant in infant feeding are reported, with illustrative charts of the resulting weight curves in 8 of the 11 cases reported.

The addition of the yeast, even in small amounts, generally resulted in diarrhea. In some cases slight stimulation in growth was evidenced and in others none at all. The author concludes that yeast should not be used as a means of increasing the antineuritic content of infants' foods.

The relationship between xerophthalmia and fat-soluble A, S. WALKER (*Jour. Amer. Med. Assoc.*, 78 (1922), No. 4, pp. 273, 274).—This paper consists of a review of the conclusions of various investigators concerning the relationship between xerophthalmia and vitamin A, and a brief report of the author's observations on the same subject.

Out of 64 rats fed on a supposedly vitamin A-free ration, 5 developed sore eyes in from 6 to 11 weeks. In another group on a diet furnishing less protein on account of the possibility of the presence of small amounts of vitamin A in the casein used as the protein, similar results were obtained except that all the animals lost weight more rapidly than those in the first group, and 6 of the 38 animals developed sore eyes. Smears and cultures showed that the organism present was a large coccus not unlike an attenuated staphylococcus. Attempts to infect the eyes of well animals or the other eye in cases in which the diseased condition appeared in only one were unsuccessful. Sections of the diseased eyes showed marked changes in the cornea only, consisting chiefly of infiltration of lymphocytes into the epithelium and in some cases the interstitial layer.

In discussing the underlying factor causing the disease, the suggestion is made of possible hereditary disposition as explaining the widely variable and anomalous results reported from various sources.

Researches on vitamin B, H. DAMIANOVICH (*Compt. Rend. Soc. Biol. [Paris]*, 85 (1921), No. 27, pp. 591, 592).—As the result of an investigation of the properties of vitamin B, the details of which are not presented, the authors advance the theory that vitamin B accelerates diastatic action, internal and external secretions, and above all the synthesis of nucleins.

Clinical researches on vitamin B, C. P. MATHEU (*Compt. Rend. Soc. Biol. [Paris]*, 85 (1921), No. 27, p. 593).—The author states that the addition of vitamin B to the diet of infants suffering from metabolic disturbances apparently increases the "index of tolerance" for food of the subjects, and results in a rapid increase in appetite, weight, and in the number of red blood cells.

Bacteria as a source of the water-soluble B vitamin, S. R. DAMON (*Jour. Biol. Chem.*, 48 (1921), No. 2, pp. 379-384, figs. 3).—The possibility that bacteria synthesize vitamin B has been tested in the case of *Bacillus paratyphosus*, *B. coli*, and *B. subtilis* by the administration of sterilized cultures of these organisms as the sole source of vitamin B to rats on an otherwise adequate diet. The continued loss of weight of the experimental animals is thought to indicate that the above organisms do not synthesize vitamins.

Studies in the physiology of vitamins.—I, Vitamin B and the secretory function of glands, G. R. COWGILL and L. B. MENDEL (*Amer. Jour. Physiol.*, 58 (1921), No. 1, pp. 131-151).—This is the detailed report of an investigation which has been previously noted from a preliminary report (*E. S. R.*, 45, p. 366).

None of the extracts tested, which had been demonstrated to contain vitamin B, produced any notable effect on the rate of flow of pancreatic juice, bile, and saliva. The intestinal mucosae from 8 polyneuritic dogs were examined and found to contain secretin. The authors conclude that "there is no direct relation between vitamin B and the secretory function of the pancreas, liver, and salivary glands."

Secretin.—V, Its effect in anemia, with a note on the supposed similarity between secretin and vitamin B, A. W. DOWNS and N. B. EDDY (*Amer. Jour. Physiol.*, 58 (1921), No. 2, pp. 296-300, figs. 2).—Further evidence that vitamin B

and secretin are not identical is furnished in this continuation of the studies on secretin previously noted (E. S. R., 39, p. 285).

Ten rabbits which had been rendered anemic by a diet of cracked polished rice were put on a full diet of oats, turnips, carrots, and cabbage. Five of the rabbits received daily subcutaneous injections of secretin dissolved in physiological salt solution and the other 5 injections of an equal amount of physiological salt solution alone. All of the animals shortly began to increase in weight and to show gradual improvement in the erythrocyte count, the latter more rapidly in the animals receiving secretin. For the first three weeks the secretin rabbits also gained in weight more rapidly than the controls.

To determine whether the marked improvement brought about by secretin might also have been induced by the addition of an equivalent excess of vitamin B, 5 rabbits were injected subcutaneously with 1 cc. of secretin from hog's intestine and 5 with vitamin B from brewers' yeast according to the method described by Voegtlin and Myers (E. S. R., 44, p. 765). At the end of one hour the erythrocyte count had increased on an average of 17.55 per cent in the animals in which secretin had been injected, while there was no increase in the erythrocyte count in the animals treated with vitamin B. It is concluded that there is no similarity between secretin and vitamin B.

Effect of heating the antiscorbutic vitamin in the presence of invertase, E. SMITH and G. MEDES (*Jour. Biol. Chem.*, 48 (1921), No. 2, pp. 323-327).—To determine whether enzyme action is an important factor in the gradual destruction of vitamin C, as suggested by Givens and McClugage (E. S. R., 43, p. 765) and others, the alcohol extract of orange juice prepared as described by Hess and Unger (E. S. R., 39, p. 771) was heated at temperatures of 38, 55, and 76° C., both in the presence and in the absence of the enzyme invertase prepared by the method described by Hudson and Paine (E. S. R., 23, p. 110). The various samples of juice thus treated were then given as the source of vitamin C to guinea pigs on a basal scorbutic diet.

That the enzyme did not contribute to the destruction of the vitamin was shown by the fact that in all cases except one the animals receiving the extract heated in the presence of the enzyme were in a less advanced stage of scurvy at the close of the period than those receiving the extract similarly heated without the enzyme. Heating at 75° either in the presence or the absence of invertase caused a more rapid destruction of the vitamin than heating at 55°, but no appreciably greater destruction appeared to take place at 38° than at room temperature.

Is sterilized lemon juice antiscorbutic? G. MOURIQUAND and P. MICHEL (*Compt. Ren. Soc. Biol. [Paris]*, 85 (1921), No. 27, pp. 470-472).—The authors report that guinea pigs subjected to a scorbutic ration plus from 5 to 10 cc. daily of lemon juice sterilized for 1½ hours at 120° C. develop scurvy after a period of from 85 to 110 days during which the animals grow normally and appear in excellent condition. The chronic form of the disease which then develops is capable of disappearing spontaneously and completely with no modification of the diet, but such animals are rendered more susceptible to the disease at a later date.

Detection of a deficit in the tissues of animals suffering from deficiency disease, W. R. HESS and N. TAKAHASHI (*Biochem. Ztschr.*, 122 (1921), No. 1-4, pp. 193-203).—To determine whether tissues of pigeons with experimental beriberi are lacking essential constituents, mice and rats were fed boiled rice with additions of tissue preparations from healthy and polyneuritic pigeons. Those fed the muscle preparations of polyneuritic pigeons did not live as long as, and lost weight more rapidly than, those fed healthy tissues. Evidence of xero-

phthemia was noted in many of the former cases. The difference in action is thought to be due to the vitamin content of the healthy tissues.

Severe infantile malnutrition.—The energy metabolism with the report of a new series of cases, F. B. TALBOT (*Amer. Jour. Diseases Children*, 22 (1921), No. 4, pp. 358-370, figs. 6).—A series of basal metabolism studies of infants suffering from varying degrees of malnutrition is reported, with the following conclusions:

"There is no appreciable change in the metabolism of cases with severe malnutrition until there is a loss of 20 per cent in the body weight. Beyond this point there is presumably a loss of subcutaneous fat and a larger body surface in relation to the body weight. With increasing malnutrition the divergence from the normal becomes greater, and body heat is lost more easily because of the lack of the insulating layer of subcutaneous fat and of the greater radiation of heat due to the relative increase in body surface as compared to the weight. When the heat loss becomes greater than the heat production the temperature becomes subnormal. This condition can only be remedied by the application of enough external heat to make up for the loss. The basal metabolism per kilogram of body weight is higher in infants with severe malnutrition than in normal average infants, being higher the greater the degree of malnutrition."

Pellagra: First, second, and third reports of the Robert M. Thompson (Thompson-McFadden) Pellagra Commission, J. F. SILER, P. E. GARRISON, W. J. MACNEAL, ET AL. (*New York: Post-Grad. Med. School and Hosp.*, 1913, I, pp. IV+148, figs. 40; 1914, II, pp. IV+169, figs. 50; 1917, III, pp. VIII+454, figs. 121).—This contains the detailed reports presented by the various members of the Thompson Pellagra Commission of the New York Post-Graduate Medical School. Several of these reports have been previously noted from their original sources.

The diet factor in pellagra, W. H. WILSON (*Jour. Hyg. [Cambridge]*, 20 (1921), No. 1, pp. 1-59, figs. 3).—In this paper the question of the etiology of pellagra is studied from the theory of protein deficiency by a comparison of the biological value of the protein, according to the method of Thomas, of a number of diets known to have been connected with pellagra, with that of others of known value in curing or preventing the disease. The diets studied included those in use during an epidemic of pellagra in the Armenian refugee camp at Port Said in 1916, those of the Rankin Farm experiment, the food of Italian peasants in pellagrous districts, and the diets of Turkish prisoners of war and convicts in Egypt. For comparison with these pellagrous diets several diets are cited on which pellagra has been known not to occur.

From the study of these pellagrous and nonpellagrous diets, the author concludes that pellagra is the ultimate result of a deficient supply of protein. This deficiency may be primary, in which the supply is insufficient for the requirement or can not be utilized to the normal extent on account of its indigestible character, or secondary in which, owing to digestive disturbances, an otherwise normal supply of protein can not be assimilated.

Indicanuria is thought to be an important indication of the loss of protein in the intestine and to be closely related to the deficiency of gastric hydrochloric acid. Work is considered to be a factor in the causation of pellagra in a community whose protein supply is on the border line between sufficiency and insufficiency.

Protein deficiency and pellagra (*Brit. Med. Jour.*, No. 3181 (1921), p. 1050).—An editorial comment on the above paper.

The blood picture in scurvy, with particular reference to the platelet, S. P. BEDSON (*Brit. Med. Jour.*, No. 3176 (1921), pp. 792, 793).—Blood platelet counts made on the blood of guinea pigs and monkeys at frequent intervals dur-

ing the course of experimental scurvy have shown that, contrary to what might be expected in severe hemorrhage such as occurs in scurvy, the blood platelet count is practically normal. A practical application of these findings is indicated from similar observations on the blood of two infants, both diagnosed as scorbutic. In the one case the blood platelet count was very low, while in the other it was normal. Both children received antiscorbutic treatment, but the former died in a few days with post-mortem findings of purpura hemorrhagica, while the latter made a rapid recovery.

Botulism.—A method for determining the thermal death time of the spores of *Bacillus botulinus*, E. C. DICKSON and G. S. BURKE (*Soc. Expt. Biol. and Med. Proc.*, 19 (1921), No. 2, pp. 99-101).—As a result of the difficulty in preventing spoilage of a small percentage of tubes in the method for determining thermal death time recommended by Bigelow and Esty (E. S. R., 45, p. 10), a method has been devised which is said to eliminate all possibility of contamination of the contents of the tubes after they have been subjected to the required amount of heat. The technique is as follows:

Three cc. of a 1 per cent glucose peptic digest liver broth adjusted to a final pH of 7.3 to 7.5 is placed in a soft glass tube 10 by 150 mm, and covered with a thin layer of oil to prevent evaporation. The medium is sterilized at 15 lbs. pressure for 30 minutes. Immediately before inoculation the tubes of broth are exposed to live steam for 20 minutes to expel the air, and a known number of spores is then added to each tube in 0.5 cc. of the medium in which they have grown. The tubes are then sealed in an oxygen flame and are ready for heating by immersion in racks into oil which is maintained at the required temperature and vigorously agitated. At the end of the heating period the tubes are removed from the oil, placed in deep pans of cold water to cool, immediately labelled, and then incubated at 37.5° C.

Incubation is continued for at least 10 days after growth is recognized, in order to allow time for the formation of toxin. The tubes are then opened under sterile conditions, deep agar, broth, and meat mediums are inoculated, and guinea pigs are immediately injected. No test is considered positive unless the broth culture within the sealed tube contains a virulent botulinus toxin at the time the tube is broken.

ANIMAL PRODUCTION.

[Work in animal husbandry at the Guam Station], C. W. EDWARDS (*Guam Sta. Rpt. 1920*, pp. 7, 10, 11, 13-15).—A general review of the work in animal husbandry is presented, and the results of experiments and observations made during the year are reported.

It was observed that difficulties in connection with breeding native mares were due largely to their lack of readily recognized oestrus periods. The results of pasturing experiments indicated that well-established lowland Paspalum pastures will support two head of native ponies per acre, and that such pastures have a larger carrying capacity than pastures with only native grass.

Pigs on Paspalum pasture appeared to thrive as well on cracked corn alone as on a mixture of two-thirds cracked corn and one-third coarsely ground cowpeas. Grade gilts pastured during October and November on sweet potatoes supplemented with velvet beans in the pod and tankage and pastured during December and January on Para grass with corn and tankage given in addition made satisfactory growth and gains. Satisfactory results were secured also with grade brood sows pastured during March and April on nearly mature velvet beans with corn fed in addition, pastured during May on ripe kafir supplemented with tankage, and fed during June on cooked breadfruit and velvet beans in the pod. With native pigs pastured on Paspalum, cracked corn and

cooked, weevil infested, dried Lima beans were practically equal in feeding value.

The data from 89 sittings and 40 artificial hatches of hens' eggs indicated that within certain limits the period of incubation is not entirely dependent upon the degree of temperature. The records submitted showed a variation in the incubation period from 17 to 23 days. In the artificial hatches the period ranged from 19 to 22 days, an average incubator temperature of 102.4° F. completing the hatch in 19 days and an average temperature of 103° in 22 days.

Equal parts of corn and mungo beans proved a better ration than corn alone for chicks from 6 to 12 weeks and from 12 to 24 weeks old. Grated coconut when used alone as a feed for chicks over 12 weeks old did not give as good results as those secured with corn alone, and it is concluded that for chickens coconut should be used only as a supplementary feed. Trial plantings of *Paspalum dilatatum* in chicken runs indicated its value for this purpose.

Butchering and curing meats in China. C. O. LEVINE (*Canton Christian Col. Bul.* 27 (1921), pp. IV+41, pls. 6).—This bulletin deals with meat conditions in China, having special reference to the meat animals of China; selection and preparation of the animals for slaughter; killing and dressing hogs, cattle, sheep, and poultry; and American and Chinese methods of curing meat.

Cooperative experiments upon the protein requirements for the growth of cattle. H. P. ARMSBY (*Bul. Natl. Research Council*, 2 (1921), No. 12, pp. 219-288, figs. 2).—This is the initial report of cooperative experiments carried on by various experiment stations under the general direction of the author to study the protein requirements of growing calves, experiments being summarized as carried on at the Massachusetts Station during 1918-19, at the Ohio Station during 1918, and at the Virginia Station during 1918-19 on a total of 26 calves. The plan of these experiments was to have them conducted uniformly at the different stations, the calves being arranged in pairs of which one calf would receive a comparatively high protein ration and the other calf a lower protein ration. The feeds used consisted of alfalfa hay, corn meal, linseed meal, and peanut meal, with oat straw and starch added in sufficient amounts to equalize the net energy of the high and low protein rations. The results of the experiments were measured as far as possible by the nitrogen balance; otherwise by weights and measurements of the calves. The following table gives the amounts of digested true protein and net energy actually consumed per 1,000 lbs. live weight according to the digestion trials compared with that computed for their consumption:

Summary of protein and energy consumed and gains in live weight.

Location and time of experiment.	Duration.	High protein rations.						Low protein rations.					
		Protein.		Energy.		Gain in live weight.		Protein.		Energy.		Gain in live weight.	
		Computed.	Actual.	Computed.	Actual.	Total.	Percentage.	Computed.	Actual.	Computed.	Actual.	Total.	Percentage.
Mass.:	Days.	Lbs.	Lbs.	Therms.	Therms.	Lbs.	P. ct.	Lbs.	Lbs.	Therms.	Therms.	Lbs.	P. ct.
1918.....	180	2.01	1.76	11.90	8.70	181.8	72.5	1.02	0.84	11.90	7.80	161.9	63.5
1919.....	180	2.24	1.95	13.50	11.59	208.3	74.1	1.42	1.06	13.35	9.87	205.4	69.1
Va.:													
1918.....	165	2.12	1.70	12.70	11.06	61.8	30.5	1.10	.71	12.26	10.84	51.1	21.7
1919.....	78	2.40	1.71	14.50	12.08	116	26.0	1.62	.87	14.50	11.55	98	20.5
Ohio, 1918...	77	.....	.....	.....	.....	141	41.0	.....	.....	.....	.....	141	43.0

The results seemed to be somewhat affected by the lack of opportunity to accustom the animals to the appliances for collecting the urine and feces, but with these irregularities the results are deemed worthy of consideration. With this particular protein mixture sufficient protein in the feed to equal the normal maintenance requirement plus the normal increase in body protein seemed to produce almost normal growth. A more liberal supply of protein seemed to distinctly stimulate the rate of growth.

The author states that it seems that current feeding standards for growth call for a much greater supply of protein than is necessary to secure satisfactory results.

Cattle feeding experiment at Green Drove, Thorney (*Olympia Agr. Co. Ltd., Research Dept. Ann. Rpt., 1 (1921), pp. 59-67*).—This is a report of a feeding experiment with 20 Irish bullocks at Green Drove, Thorney, from February 14 to April 19, 1920. The bullocks were divided into two lots called the control and the experimental lots. The former lot received 112 lbs. mangels and 4 lbs. mixed cake, while the experimental lot received 84 lbs. mangels and 5 lbs. tall corn. Both lots received straw ad libitum.

The average gains per head during this period were 67.9 lbs. for the control and 93.8 lbs. for the experimental lot.

One half of the bullocks were marketed April 19, and the other half (5 in each lot) were kept on for 23 days. Each lot averaged 28 lbs. per head of gain for that period.

Cattle feeding experiment at Cherry Orchard Farm, Barlby (*Olympia Agr. Co. Ltd., Research Dept. Ann. Rpt., 1 (1921), pp. 68-75*).—This is the report of an experiment to compare the feeding values of meadow hay, oat straw, and wheat straw when fed in quantities proportional to their respective market price, i. e., 1 lb. of hay=2 lbs. of oat straw=2.5 lbs. of wheat straw.

Three lots of cattle were selected, composed of 4 bullocks and 4 heifers in each lot, with an average weight of 514, 523, and 517.9 lbs., respectively. The following basal ration per head per day was fed each lot: Twenty-eight lbs. of pulped roots, 3 lbs. of straw chop, and 2 lbs. of linseed cake and pig meal. The different lots were supplemented by the following feeds: Lot A with 3.5 lbs. of hay, lot B 7 lbs. of oat straw, and lot C 8.75 lbs. of wheat straw. The rations had to be slightly modified during the experiment because of lack of some of the products. The average gains for 68 days were for lot A 81.5 lbs., lot B 67.9 lbs., and lot C 93.5 lbs. At the end of this period lots B and C were changed so that lot B received wheat straw and lot C received oat straw. The average gains for the next 43 days were lot A (hay) 40 lbs., lot B (wheat straw) 29.6 lbs., and lot C (oat straw) 20 lbs.

Due to the observations made and the influence of other factors, the belief is expressed that the hay lot did the best throughout the test, followed by the wheat straw lot, with the oat straw lot last.

Effect of winter rations on pasture gains of calves, E. W. SHEETS and R. H. TUCKWILLER (*U. S. Dept. Agr. Bul. 1042 (1922), pp. 15, figs. 9*).—An outline of the experimental work is presented and the results secured are tabulated and discussed.

Feeding trials were made for three years during an average winter period of 134 days, in cooperation with the West Virginia Experiment Station on a farm in southeastern West Virginia, with grade Shorthorn, Hereford, and Aberdeen-Angus calves averaging 385 lbs. at the beginning of the winter period and being 1 year old the following spring. The calves were divided into three uniform groups of 10 calves each for the winter feeding of different rations, and in summer for an average of 168 days all were turned on to a 200-acre pasture, one-half woodland, with a fairly good growth of blue grass and white

clover in the unwooded portion. The composition of the feeds used (corn silage, mixed hay, rye hay, clover hay, shelled corn, wheat bran, linseed meal, and cottonseed meal), as determined and tabulated, was somewhat below the average. The mixed hay fed was approximately half timothy and half clover.

The calves of lot 1 receiving each an average daily ration of 12.3 lbs. corn silage, 3.9 lbs. rye hay, and 0.6 lb. cottonseed meal made an average total winter gain of 55 lbs., as compared with 46 lbs. for lot 2, receiving 12.3 lbs. corn silage and 4.9 lbs. clover hay, and with 98 lbs. for lot 3, receiving 9.2 lbs. mixed hay and 2.6 lbs. of a grain mixture consisting by weight of three parts corn, one part bran, and one part linseed meal. The average total winter and summer gains per calf for the three lots were 248, 238, and 280 lbs., respectively. It is pointed out that in wintering the calves 4.9 lbs. of clover hay were practically equal to 3.9 lbs. of rye hay and 0.6 lb. of cottonseed meal as a supplement to corn silage.

A study of the cost of the rations showed that corn silage and clover hay fed to lot 2 was the cheapest ration and cost least per pound of yearly gain. Lot 3, fed mixed hay and grain, made a large gain, but cost \$6.46 more per year per calf than lot 1 and \$7.92 more per calf than lot 2. It was concluded that a ration containing silage for wintering steer calves is more economical than dry roughage with grain, considering the gains made during the winter and the summer following. The results further indicated that the cost of wintering a steer calf is approximately two-thirds of the cost of keeping the calf one year, and that the profit, therefore, is determined largely by the cost of the winter ration.

Aberdeen-Angus cattle, J. R. BARCLAY (*Highland and Agr. Soc. Scot. Trans.*, 5. ser., 33 (1921), pp. 80-104, figs. 8).—This brief sketch of the origin and development of Aberdeen-Angus cattle gives special credit to three men, H. Watson, W. M'Combie, and G. Macpherson-Grant, called, respectively, the founder, the emancipator, and the refiner of the breed. An account of the success of Aberdeen-Angus cattle is given.

Karakul sheep, R. O. WAHL (*Union So. Africa Dept. Agr. Jour.*, 1 (1920), Nos. 6, pp. 509-527, figs. 9; 7, pp. 626-642, figs. 11).—The author deals with the origin and management of Karakul sheep and their introduction into other countries. A description of the sheep is furnished as to conformation and condition of fleece desired in lambs and in mature sheep, together with a classification of the pelts of the lambs.

The results of breeding investigations carried on at the Grootfontein School are also reported.

Suffolk sheep, S. R. SHERWOOD (*Jour. Min. Agr. [London]*, 28 (1922), No. 10, pp. 880-886, pl. 1).—A brief account is given of the history, description, and management of Suffolk sheep, with some reasons for their popularity in other countries as well as Great Britain.

Facts that sheepmen desire to know, R. C. MILLER (*Breeder's Gaz.*, 81 (1922), No. 5, pp. 139, 140).—The author gives an account of the sheep and goat investigations of the U. S. Department of Agriculture. Some of the results which have been obtained at Beltsville, Md., on farm stock studies and milch goat improvement; at Dubois, Idaho, on range sheep investigations; and at Vienna, Va., on investigations of the sheep diseases are briefly reported.

Note on inheritance in swine, A. M. CARR-SAUNDERS (*Science*, n. ser., 55 (1922), No. 1410, p. 19).—The author reports several crosses of Berkshire sows with Large Black boars in which the F₁ pigs have had erect ears (Berkshire), uniform black coat without any white (Large Black), and nose and body intermediate between the two breeds. In the reciprocal cross the same results

have occurred except in the case of the color, in which six white points have occurred on some of the individuals as well as truly spotted males.

[**Swine feeding at the Huntley, Mont., Reclamation Project Experiment Farm**], D. HANSEN, A. E. SEAMANS, and R. E. HUTTON (*U. S. Dept. Agr., Dept. Circ. 204 (1921), pp. 17-26*).—Experiments continued from previous years (E. S. R., 44, p. 770) on the utilization of hogs of dry-land pasture crops and of irrigated crops in rotation, and on feeding hogs while on pasture and in the dry lot are reported. The annual results for the entire period of the experiments are for the most part summarized in tables.

In experiments in progress for the purpose of determining a system of continuous summer pasturage, hogs were pastured on winter rye, field peas, beardless barley, and corn grown in rotation and on alfalfa and brome grass representing the perennial crops. The work is being continued, and the results briefly noted and discussed, for the different years are not summarized and no conclusions are drawn.

In crop utilization and feeding experiments with hogs quarter-acre plats of third-year alfalfa were pastured with fall pigs from April to July and with spring pigs from July to October at the rate of 2,000 to 2,500 lbs. of live weight per acre. The pigs were alternated from one half of each plat to the other half every 10 or 12 days and were fed 2 lbs. of corn daily per 100 lbs. of live weight. The average results on an acre basis for the years 1914 to 1920, inclusive, showed that 19.3 pigs were pastured in spring and 32.7 in summer, the average pasturing period being 147.2 days. The pigs made an average daily gain of 0.63 lb. and consumed 2.87 lbs. of grain per pound of gain.

Spring pigs used in the alfalfa pasturing experiments were pastured on a quarter-acre plat of corn immediately after the summer pasturing period. The average results on an acre basis for 1912-1920, inclusive showed that 18.2 pigs pastured 23 days made a total gain of 689 lbs., equivalent to 100 lbs. of gain from 445 lbs. of grain consumed, the estimated yield of corn per acre being 54.3 bu.

Similarly, the average results also on an acre basis of an experiment in pasturing hogs from 1916 to 1920 on corn in which rape had been drilled about the last of July show that 17.6 hogs were pastured 32.6 days and made a total gain of 716 lbs. or 100 lbs. for each 386 lbs. of grain eaten, the yield of corn being estimated at 52.9 bu. per acre.

A number of feeding experiments with hogs were made in cooperation with the Montana Experiment Station. In comparing different supplements to corn a ration consisting of one part corn and three parts skim milk produced more rapid gains and required less concentrates per 100 lbs. gain than any of the other rations tried. In this ration every 5.2 lbs. of skim milk fed was equal to 1 lb. of grain, while in a ration consisting of one part corn, one part mill feed, and two parts skim milk 3.3 lbs. of the milk saved 1 lb. of grain.

Spring pigs on alfalfa pasture receiving corn and tankage made slightly more rapid gains than those receiving corn alone. Two self-fed lots in this experiment made much more rapid gains, but consumed about 10 per cent more grain than two lots receiving 2 lbs. of grain per 100 lbs. of live weight. The excess of grain consumed was more than offset by the lower cost of pasture per 100 lbs. of grain. The pigs in these different lots were taken from the pasture to dry lots and self-fed shelled corn, tankage, and alfalfa hay. The length of the finishing period to bring them to 200 lbs. varied from 43 days for the lots self-fed on pasture to 85 days for the check lot which received no grain on pasture. The combined results of the pasture and dry lot periods showed that the time required to bring the pigs from 65 lbs. to 200 lbs. varied from

103 days for the pigs self-fed corn and tankage on pasture to 149 days for the check lot receiving no grain on pasture.

Hogging down [alfalfa and clover] (*South Carolina Sta. Rpt. 1921, pp. 14, 15*).—Twenty shotes averaging 103 lbs. per head were turned on one-half acre of alfalfa and one-half acre of crimson clover February 26, 1921. During 28 days they consumed 1,204 lbs. of corn in addition to the pasture, and gained an average of 1.24 lbs. per hog per day.

Thirteen shotes averaging 80 lbs. per head grazing on an acre of alfalfa for 35 days during March and April made a total gain of 450 lbs.

Berkshire pigs, S. SPENCER (*Jour. Min. Agr. [London], 28 (1922), No. 10, pp. 887-890, pl. 1*).—The author states that the Berkshire breed is one of the oldest breeds of hogs. A description of the first Berkshires is given, together with an estimate of their popularity in later years. A standard of excellence is included for Berkshires as approved by the British Berkshire Society.

Stallion enrollment.—X, Report of stallion enrollment work for the year 1921 with lists of stallions and jacks enrolled (*Indiana Sta. Circ. 104 (1921), pp. 72, fig. 1*).—This report of the stallion enrollment board consists mainly of a directory of enrollments and renewals of the calendar year 1921, classified by counties. During the year there were enrolled 1,442 purebred stallions, 472 grade and scrub stallions, 814 registered jacks, and 295 grade and scrub jacks. These totals are all lower than in 1920 (E. S. R., 44, p. 774), but the proportion of purebred stallions and jacks is higher.

The poultry keeper's vade mecum, E. BROWN (*London: Stanley Paul & Co., (1921), pp. 170, figs. 21*).—This work is in the form of an elementary handbook for the English poultryman, and discusses the breeding, feeding, care, and management of poultry, as well as giving a brief description of the different breeds.

Early-maturing v. late-maturing White Leghorn pullets, D. C. KENNAED (*Ohio Sta. Mo. Bul., 6 (1921), No. 11-12, pp. 163-167*).—In the fall of 1920, from 300 pullets hatched April 7, 50 of the best birds were selected as lot 1. Then 50 of the poorest or slowly maturing pullets were selected as lot 2. Lot 2 was apparently in good condition except for size and maturity. All birds in lot 1 had laid in October or November, whereas the birds in lot 2 did not begin laying till December 15.

By October 1, 1921, the birds in lot 1 had laid 7,995 eggs against 5,666 eggs for lot 2. The feed costs were about the same for each lot. The profit over feed cost per bird for lot 1 was \$4.16 and \$2.45 for lot 2. The loss from mortality and culling was much greater for lot 2, being estimated at 12 and 82 cts. per bird, respectively.

The slow-maturing birds were, of course, smaller at the start, but they never attained the same average weight as the early-maturing birds. "From the point of egg production, size of birds, mortality, and the number of culls at the end of the first year, it would seem that the inferiority of the slow-growing pullets is due to the permanent handicap which continues, at least during the first year and probably indefinitely." The experiment indicates that closer culling should be practiced, and that no slowly maturing birds should be used as breeders. The experiment is being continued with the same birds for another year.

The rate of growth of Single Comb Rhode Island Reds, B. F. KAUPP (*Poultry Sci., 1 (1921-22), No. 2, pp. 39-43, fig. 1*).—In an experiment to determine the growth expectancy of Rhode Island Red chicks on three different rations, the cockerels were found to increase in weight faster than the pullets, especially from the twelfth to the twenty-fifth week. Average weekly weight and growth curves of the cockerels and pullets are given.

Standard varieties of chickens.—V, The bantam breed and varieties, R. R. SLOCUM (*U. S. Dept. Agr., Farmers' Bul. 1251 (1921), pp. 24, figs. 32*).—This describes the standard Bantam breeds and varieties, notes their characteristics, and discusses their care and the purposes for which they are kept. Among the breeds and varieties described are the Game, Black-breasted Red Malay, Rose-comb, Booted White, Brahma, Cochin, Japanese, Polish, and Mille Fleur Booted Bantams, the Sebright, and the Silkie. The more important varieties under each breed are briefly noted.

Linkage in poultry, J. B. S. HALDANE (*Science, n. ser., 54 (1921), No. 1409, p. 663*).—The author reports a test made for linkage in poultry in which he considered two sex-linked factors, B, the presence of which determines barring, and S, which inhibits yellow pigment and converts gold into silver feathers. A Brown Leghorn cock of *bs bs* composition was mated to Barred Plymouth Rock hens of BS composition. The F_1 males were all BS *bs* and were mated to *bs* Brown Leghorn hens. Out of 78 F_2 offspring produced, there were 27 birds which were unbarred silver or barred gold which were, therefore, produced by crossing over. The crossing over percentage for these factors is, then, 34.6 ± 3.6 .

The practical value of mapping these factors is brought out because of the possible similarity with the egg-laying factor which Pearl states is located in the sex chromosomes.

A simple method of obtaining premature eggs from birds, O. RIDDLE (*Science, n. ser., 54 (1921), No. 1409, pp. 664-666*).—Experiments are cited in which pigeons were stimulated to lay immaturely formed eggs from $6\frac{1}{2}$ to 25 minutes after the injection of pituitrin. Similar results were obtained with common fowls. This is cited as a method for the examination of immature eggs without killing the birds to obtain them.

Hatchability and chick mortality, L. C. DUNN (*Poultry Sci., 1 (1921-22), No. 2, pp. 33-38*).—The results of data accumulated on the relation of the hatchability of eggs and chick mortality are reported. With 867 chicks hatched in 1921 and 1,577 chicks hatched in 1920, the coefficient of correlation between the hatching percentage of the eggs and the percentage of chicks dying during the first three weeks was practically zero. This means that separate factors probably determine the hatchability of the eggs and the vigor of the chicks.

A comparative study of the body temperature of the different species and some representative breeds of poultry.—A preliminary report, F. M. FRONDA (*Poultry Sci., 1 (1921), No. 1, pp. 16-22, figs. 12*).—Temperatures taken every two hours during the day are reported on the following breeds of chickens: Single Comb White Leghorn, Black Leghorn, White Wyandotte, Black Minorca, Bantam, Cornish, and Langshan, as well as on pheasants, pigeons, Mallard ducks, geese, turkeys, and guineas.

The normal temperature of the chickens varied from 104.6° to 109.4° F., the average being 106.7° . The highest temperatures occurred from 12 to 4 o'clock. Graphs showing the daily variation in temperature are given for each breed.

Body temperature of newly hatched chicks, L. E. CARD (*Poultry Sci., 1 (1921), No. 1, pp. 9-15, figs. 6*).—This is the report of an experiment in which 119 Single Comb White Leghorn chicks were used at the New York Cornell Experiment Station to determine the temperature of chicks (male and female) on each of the first 5 days after hatching. Daily weights of part of the chicks were also taken.

The average normal temperature of the chicks the first day was found to be 106° F. in the morning and 102° in the evening. The morning temperature seemed to decrease on the average during the first 5 days, whereas the evening temperature tended to rise during that period. The chicks lost approximately one-third their original weight during the first 5 days, which the author

attributes mainly to the lack of water or milk, as the chicks had neither during this time.

The relation of the keel bone to egg production, V. S. ASMUNDSON (*Sci. Agr.*, 1 (1921), Nos. 1, pp. 30-33; 2, pp. 63-67, figs. 2).—The purpose of this study was to determine to what extent variation in structure was related to egg production, dealing especially with the size and position of the keel bone and the size of the abdomen and pelvic structures.

For this work 280 Single Comb White Leghorn hens from the New York Cornell Experiment Station flock were measured, and the correlation was calculated between the measurements of the birds and egg production during different parts of the year, as well as the total egg production and the length of the laying period. A few of the more important correlations obtained are as follows: Length of keel and total egg production, $0.0319 \pm .0403$; curvature of keel and total egg production, $0.1157 \pm .0398$; depth of body (back to front of keel) and total egg production, $0.2530 \pm .0377$; depth of body (back to posterior end of keel) and total egg production, $0.3684 \pm .0348$; width of hips and total egg production, $0.3560 \pm .0352$; distance between pelvic bones and total egg production, $0.3479 \pm .0354$; and weight of bird and total egg production, $0.2278 \pm .0382$.

The author concludes that there is an "egg type" to be selected for, but that several anatomical characters must be taken into consideration.

Grain and sour skim milk as a laying ration, J. H. MARTIN (*Poultry Sci.*, 1 (1921-22), No. 2, p. 50).—In an experiment with three pens of 20 White Wyandotte pullets each sour milk plus grain gave better results than were obtained by feeding grain and dry mash containing meat scrap.

The Canadian record of performance "A" for purebred poultry, H. S. ARKELL (*Canada Dept. Agr., Live Stock Branch, Canad. Rec. Performance "A" Purebred Poultry Rpt. 1 (1919-20)*, pp. 37).—This is the first yearly report of the record of performance of purebred poultry in Canada for the period from September 1, 1919, to November 28, 1920. The owners and the records of the birds which were awarded certificates and advanced certificates are listed. The requirement for certificate is that the bird must have laid 150 eggs within 52 consecutive weeks, and for advanced certificate 225 eggs.

Egg-laying competitions.—Their relation to the industry of egg production, H. E. IVATTS (*Highland and Agr. Soc. Scot. Trans.*, 5. ser., 33 (1921), pp. 230-243).—The author discusses the magnitude of the poultry industry, and shows how egg-laying tests have helped to improve the poultry by acting as an incentive to careful breeders.

Some problems of the fox-raising industry, A. HUNTER (*Canada Council Sci. and Indus. Research Bul. 8 (1920)*, pp. 12).—In this article the author discusses the possibilities of the fox-farming industry as it exists, and then he takes up some of the reasons why the returns are not greater. Among the more important factors which tend to reduce the returns are infectious diseases, parasites, food poisoning, and imperfect nutrition.

Food requirements of the ranch fox, G. E. SMITH (*Canada Council Sci. and Indus. Research Rpt. No. 9 (1921)*, pp. 12).—This paper recommends different rations which have proved successful at the Research Station at Mountain Road, Hull, P. Q., for ranch foxes. Rations are also suggested for growing and breeding foxes. Less trouble occurs with the least possible amount of over-feeding, so it is advised that only foxes of the same size be fed together.

Animal fibers used in the textile industry, A. F. BARKER (*Sci. Agr.*, 1 (1921), No. 1, pp. 34-37, figs. 7).—The author describes the animal fibers of commerce and briefly discusses the origin of the different classes of wool-producing animals.

DAIRY FARMING—DAIRYING.

Pasturing experiments with dairy cows [at the Huntley, Mont., Reclamation Project Experiment Farm], J. B. SHEPHERD (*U. S. Dept. Agr., Dept. Circ. 204* (1921), pp. 26-31).—The experiments reported were conducted in continuation of previously noted work (*E. S. R.*, 44, p. 775). As in the preceding year, the largest net income in 1920 was secured from the complex irrigated pasture mixture composed of five grasses and two clovers as compared with the same mixture with white clover and alsike clover or brome grass and rye grass omitted. The results for three years are summarized in a table.

A further study of the carrying capacity of an acre of irrigated pasture sown with the complex mixture showed that on the average for the past two years pasturage was furnished at the rate of about two cows per acre for 139 days and that the carrying capacity was increased by about one-fourth by top-dressing yearly at the rate of 12 loads of manure per acre.

Feed cost of milk production, J. W. HENDRICKSON and C. W. JONES *Hoard's Dairyman*, 63 (1922), No. 7, pp. 236, 237).—Data collected from January 1, 1915, to January 1, 1920, from 208 yearly lactation periods on 75 different cows at the University of Nebraska show that it required the following average amounts of concentrates to produce 100 lbs. of milk or 1 lb. of butter fat, respectively, by the different breeds: Holstein 39.69 and 11.17 lbs., Jersey 46.46 and 8.73, Guernsey 46.23 and 10.09, Ayrshire 40.22 and 10.14, and Shorthorn 49.86 and 12.07 lbs. The kind of each concentrate fed and the amounts of hay and silage are also given in tabular form.

The testing of purebred cows in New South Wales, L. T. MACINNES (*N. S. Wales Dept. Agr., Farmers' Bul. 142* (1921), p. 36).—This is a report of the testing of purebred dairy cattle in New South Wales from March 1, 1920, to February 28, 1921. The 532 cows which fulfilled the butter fat requirements for 273 days during this period are listed. Statements by the owners of these cows are included, telling the rations fed while on the test.

Herd testing, R. T. ARCHER (*Jour. Dept. Agr. Victoria*, 19 (1921), No. 8, pp. 484-489).—This is a report of results obtained during nine years' cow-testing work by the Victoria Department of Agriculture.

The variation in the per cent of fat in successive portions of cow's milk, A. C. RAGSDALE, S. BRODY, and C. W. TURNER (*Jour. Dairy Sci.*, 4 (1921), No. 5, pp. 448-450, fig. 1).—An experiment is reported in support of the gravity theory in explaining the reasons for higher fat percentage of the milk drawn from a cow during the last part of the milking. Successive portions of milk drawn from a cylinder after standing three hours agreed very closely in fat percentage with successive portions drawn from one teat of a cow after standing two hours. Thorough manipulation of the udder produced almost a uniform fat percentage in successive portions of milk.

Bacterial content of milk (*South Carolina Sta. Rpt. 1921*, pp. 23, 24).—A study of the bacterial content of milk from the time it is milked until it reaches the consumer indicated that with a low initial bacterial content there is no marked increase during the first four hours. The bacterial content of milk from different cows was found to vary widely.

The spoiling of milk, W. SADLER and M. J. MOUNCE (*Sci. Agr.*, 2 (1922), No. 7, pp. 213-224).—The authors present the results of an investigation on the length of time required for samples of milk from four different sources in British Columbia to coagulate. When incubated at 37.5° C. the shortest time reported in 245 samples was 9 hours, whereas the longest time was 48 hours. Studies were also made of the bacteria dissolving the coagulum, the most com-

mon one found being a Gram-positive staphylococcus which ferments glucose and lactose to acid and liquefies gelatin. More than half of the staphylococci found were from milk procured under aseptic conditions and, therefore, must have been in the normal flora of the udder.

In how far is the bacterial count of milk influenced by the dirt content? H. A. HARDING, M. J. PRUCHA, E. F. KOHMAN, H. M. WEETER, and W. H. CHAMBERS (*Jour. Dairy Sci.*, 4 (1921), No. 5, pp. 430-447, fig. 1).—This material has been previously reported (*E. S. R.*, 46, p. 373).

Butter making on the farm, R. H. LEITCH (*West of Scot. Agr. Col. Bul.* 98 (1921), pp. 115-176, pls. 8, figs. 22).—In this bulletin the author gives directions for the manufacture of fresh butter on the farm, discussing the cattle barn and precautions to prevent contamination of the milk, the separating and handling of the cream, and the churning, packing and judging of the butter.

Butter and cheese control schemes of the Irish Agricultural Organization Society, Ltd.—Annual report for season 1920-21, D. HOUSTON (*Irish Agr. Organ. Soc., Butter and Cheese Control Schemes, Ann. Rpt., 1920-21*, pp. 72, pl. 1, figs. 8).—This is a report of the bacteriologist of the Irish Agricultural Organization Society Butter Control Scheme in which the methods of control in the cooperative creameries are described. The investigational work on the control of undesirable organisms, as well as other suggestions tending toward the production of a standard high-grade butter, is noted. The progress of the cheese control committee is also discussed. Copies of the butter and cheese control regulations are appended to the report.

Some light on Canadian Cheddar cheese, A.-T. CHARRON (*Sci. Agr.*, 2 (1922), No. 7, pp. 240-242).—In a comparison of the cheese of the Provinces of Quebec and Ontario, examinations and chemical analyses were made of 25 samples. The results showed that the average of the 16 Quebec cheeses contained a little higher percentage of nutrients and a little less water than the 9 Ontario cheeses. Otherwise there was no difference.

Bacterial cultures.—Their use in Swiss cheese making, L. A. ROGERS (*N. Y. Prod. Rev. and Amer. Creamery*, 53 (1922), No. 11, p. 490; also in *Pacific Dairy Rev.*, 26 (1922), No. 3, pp. 12, 13).

Experiments in the manufacture of rennet, R. H. LEITCH (*West of Scot. Agr. Col. Bul.* 92 (1919), pp. 13-37, pls. 3, figs. 4).—The author reviews the natural sources of rennet and cites several methods of preparing rennet.

According to the results reported, the most success was obtained by removing the abomasum of calves not over one week old, cleaning it of its contents, salting inside and out, inflating, and drying at from 60 to 65° F. for from 2 to 3 weeks, after which it was piled up and cured 4 to 5 months. The pyloric end of the stomach was then discarded, and the rest was cut in small pieces and soaked according to the following formula for about 12 days, with frequent stirring: Water 100 lbs., salt 5 lbs., calcium chlorid 5 lbs., glycerin 5 lbs., and dried stomachs 10 lbs. The solution was decanted off and cleared by filtration, clarification, or precipitation, the last method giving the best results. The solution was then colored and stored in a cool, dark place in air-tight containers.

Whey butter, H. H. DEAN (*Agr. Gaz. Canada*, 9 (1922), No. 2, pp. 120-122).—The results of a study of whey butter, carried on cooperatively by the Ontario Agricultural College and the Wisconsin Experiment Station, indicate that a very fair quality of butter can be made from whey cream, comparing favorably with butter made from similar cream separated from whole milk, both when fresh and when held in cold storage.

VETERINARY MEDICINE.

Veterinary hygiene, R. G. LINTON (*New York: William Wood & Co., 1921, pp. XIV+429, figs. 92*).—The several sections of this work deal respectively with water (pp. 1-36), meteorology (pp. 37-49), sanitation (pp. 50-75), air and ventilation (pp. 76-109), building construction (pp. 110-192), preventive medicine (pp. 193-372), and sanitary law (pp. 373-415).

Zoology for medical students, J. G. KERR (*London: Macmillan & Co., Ltd., 1921, pp. X+485, figs. 199*).—This textbook is based upon a lecture course given by the author to medical students during recent years at the University of Glasgow.

The register of veterinary surgeons (*London: Roy. Col. Vet. Surg., 1922, pp. XVI+352, fig. 1*).—This registry includes a list of all members of the Royal College of Veterinary Surgeons, corrected to January 1, 1922.

Annual report of proceedings under the Diseases of Animals Acts, the Markets and Fairs (Weighing of Cattle) Acts, etc., for the year 1920, S. STOCKMAN (*Min. Agr. and Fisheries [London], Ann. Rpts. Proc. Diseases Anim. Acts, 1920, pp. 104*).—This is the usual annual report (E. S. R., 45, p. 177) upon the occurrence of and work with foot-and-mouth disease, rabies, hog cholera, glanders, anthrax, sheep scab, parasitic mange, epizootic abortion in cattle, rinderpest in Belgium, foot-and-mouth disease in Jersey, etc. During 1920 there were 94 outbreaks of foot-and-mouth disease in 21 counties in England and one county in Wales.

Annual report of the veterinary service for the year 1919-20, W. LITTLEWOOD ET AL. (*Egypt Min. Agr., Vet. Serv. Ann. Rpt., 1919-20, pp. 47*).—This is the usual annual report (E. S. R., 45, p. 382), dealing with the occurrence of contagious diseases of live stock and the work of the veterinary pathological laboratory and the School of Veterinary Medicine.

Air carriage of pathogenic and other organisms, J. B. BUXTON and H. R. ALLEN (*Jour. Hyg. [Cambridge], 20 (1921), No. 2, pp. 173-175; also in Vet. Rec., n. ser., 1 (1921), No. 47, pp. 921-923*).—Experiments reported indicate (1) that under favorable conditions, such as a direct current of air through a building, organisms from animals may be disseminated over distances up to 150 ft. from the building; (2) that *Bacillus welchii* is frequently present in the dust and dirt of buildings in which horses and small laboratory animals (guinea pigs and rabbits) are housed; and (3) that under suitable conditions spore-bearing anaerobes such as *B. welchii* may be carried with infected dust for a distance of at least 90 ft. and probably considerably farther.

Studies in pathogenic anaerobes.—II, Principles concerning the isolation of anaerobes, H. H. HELLER (*Jour. Bact., 6 (1921), No. 5, pp. 445-470*).—Continuing the studies on pathogenic anaerobes previously noted (E. S. R., 45, p. 480), the author analyzes some of the principles governing the isolation of anaerobic organisms and calls attention to some of the simple precautions which must be taken to obtain good results. It is emphasized that success depends more upon the critical sense of the worker than upon the method employed. In particular, a critical eye for the morphology and staining reactions of anaerobes is imperative. For routine work heating the material at 70° C. in pipettes is recommended. Chopped beef heart, preferably containing a little peptic digest broth, at a reaction of pH=7.2 is recommended as a routine medium for most of the anaerobes studied in the pathological laboratory. Peptone liver agar is recommended as a medium for dilution shakes, a technique which is preferred to other colony methods.

It is emphasized in conclusion that when once pure great care should be taken to keep the cultures pure. This can be accomplished by avoiding reincubation,

prolonged incubation in closed jars, and storing in closed cans or in dusty places, and by using only autoclaved media for the preservation of type cultures.

Contribution to the knowledge of nonspecific immunotherapy, GRAWERT (*Berlin. Tierärztl. Wchnschr.*, 37 (1921), No. 52, pp. 613-616).—The author recommends nonspecific protein therapy in veterinary practice for the treatment of all chronic skin diseases, for chronic diseases of the mucous membranes, such as vaginal catarrh and chronic intestinal catarrh, and for diseases of obscure origin, such as foot-and-mouth disease, joint-ill, canine distemper, etc. Two commercial preparations are described, ergolactin, which is essentially sterile milk, and ergotropin, a normal serum plus bacterial protein. The results obtained in the treatment of several diseases with these preparations are summarized, and their use in distemper is discussed in detail.

The immunizing properties of anthrax bacilli killed by alcohol-ether, A. STAUB and P. FORGEOT (*Compt. Rend. Soc. Biol. [Paris]*, 85 (1921), No. 28, pp. 646, 647).—A brief note is given of successful attempts at immunizing guinea pigs against anthrax by successive subcutaneous injections of small but increasing doses of anthrax bacilli killed by alcohol and ether.

The serum diagnosis of dourine, IV, V (*Berlin. Tierärztl. Wchnschr.*, 37 (1921), Nos. 26, pp. 305, 306; 52, pp. 617, 618).—In continuation of the series of studies on dourine previously noted (*S. S. R.*, 45, p. 785), two papers are presented.

IV. Agglomeration and agglutination, Dahmen and David.—A study is reported of the value of the agglomeration and the agglutination tests for dourine, the former test suggested by Laveran and Mesnil (*E. S. R.*, 17, p. 81). A drop of the blood serum of highly infected rats is mixed with a drop of the serum to be tested, while on the same slide another drop of the infected serum is mixed with a drop of serum known to be negative. If the serum to be tested contains trypanosomes a clumping, first in the form of a rosette and then of larger round balls, is said to take place. This test was found to give reliable results, but the macroscopic agglutination test proved unreliable.

V. Lipoid precipitation, H. Dahmen.—In the technique for the lipoid precipitation test described in the third paper of the series, difficulty has been encountered in the tendency of the alcoholic extract of trypanosomes to become cloudy on the addition of the salt solution. It is stated that this can be avoided by blowing in the salt solution rapidly from a wide-mouthed pipette.

Complement fixation and dourine, W. NUSSHAG (*Berlin. Tierärztl. Wchnschr.*, 37 (1921), No. 34, pp. 402, 403).—This is a brief discussion of the author's experience with the complement fixation test for dourine. The test is considered of doubtful value, and reliable only when the results are positive. Case reports are given showing that even positive results are sometimes misleading, since antibodies appear late in the course of the disease, with the result that at times the reaction becomes positive only after the disappearance of the clinical symptoms.

Experimental investigation of foot-and-mouth disease.—V, The standardization of foot-and-mouth disease sera, J. WALDMANN and J. PAPE (*Berlin. Tierärztl. Wchnschr.*, 37 (1921), No. 38, pp. 449, 450).—As a method of comparing the strength of different immune sera for foot-and-mouth disease, the authors have used the subcutaneous inoculation of guinea pigs as described in their previous paper (*E. S. R.*, 46, p. 277). The animals are first injected subcutaneously with varying amounts of the serum to be tested, and after an interval of 24 hours receive a cutaneous injection of the virus of foot-and-mouth disease. The amount of serum which will prevent the appearance of the general symptoms of foot-and-mouth disease is considered the minimum protective dose. As tested in this way, Loeffler's serum proved twenty times as

active as the serum from convalescent animals. In normal bovine and horse serum no immune substances could be detected.

Antipneumococcus protective substances in normal chicken serum, C. G. BULL and C. M. McKEE (*Amer. Jour. Hyg.*, 1 (1921), No. 3, pp. 284-300).—Previously noted from a preliminary report (E. S. R., 45, p. 681).

Tick paralysis, S. DODD (*Jour. Compar. Path. and Ther.*, 34 (1921), No. 4, pp. 309-323).—This form of paralysis accompanied by other symptoms, which is most common in the domesticated animals but is occasionally reported in human beings, is well known along the whole of the eastern coast of Australia. The account presented includes a report of three experiments conducted, one with the guinea pig and two with the dog. The experiments confirm what has been popularly known for several years, namely, that one of the so-called scrub ticks is capable of producing a very fatal affection in animals, the main feature of which is a progressive motor paralysis. The particular species of tick responsible for this condition in Australia has now been determined to be *Ixodes holocyclus*. It has been shown that one tick is quite sufficient to set up a train of symptoms of intoxication and even death. No studies have yet been made of the biology of this tick.

The value of flavin compounds in experimental tuberculosis, S. A. PETROFF (*Amer. Rev. Tuberculosis*, 5 (1921), No. 8, pp. 656-661).—Tests of the bactericidal properties for tubercle bacilli in vitro of solutions of acriflavin and proflavin, and of the value of these compounds as therapeutic agents in experimental tuberculosis of guinea pigs and rabbits, are reported.

Acriflavin was found to inhibit the growth of tubercle bacilli in a veal infusion of 4 per cent glycerin broth in a dilution of 1:50,000, and proflavin in a dilution of 1:25,000. As therapeutic agents for guinea pigs previously injected with human tubercle bacilli and rabbits injected with bovine tubercle bacilli these preparations proved of no value, but tended to accelerate the progress of the disease.

The control of avian tuberculosis by means of the intracutaneous tuberculin test for the detection of infected birds, PRÖSCHOLDT (*Berlin. Tierärztl. Wchnschr.*, 37 (1921), Nos. 47, pp. 553-556, figs. 3; 48, pp. 565-567).—The author advocates the use of the tuberculin test, applied intracutaneously in the wattle, as a means of detecting tuberculosis in fowls before the appearance of clinical symptoms. The reactors are removed and slaughtered and the pens thoroughly disinfected. After four weeks the test is applied to the doubtful reactors of the previous test, and if necessary a third test is given at the end of another month. The technique of the test is described, and data are presented on its practical application.

A comparative study of bovine abortion and undulant fever from the bacteriological point of view, Z. KHALED (*Jour. Hyg. [Cambridge]*, 20 (1921), No. 4, pp. 319-329, figs. 2).—The author's studies have been summarized as follows:

"Morphologically *Bacterium abortus* and *B. melitensis* are identical. The 'coccoid' form is not a constant feature, and a more satisfactory generic name would be 'Brucella' (E. S. R., 43, p. 880). The organisms can not be differentiated by cultural, biochemical, or staining methods, or by the agglutination reaction. From absorption experiments it would appear that *B. melitensis* is a substrain of *B. abortus*. Dose for dose, *B. abortus* is much less virulent for the guinea pig than *B. melitensis*, approximately about 1:6. Immunization of monkeys (one experiment only) with killed suspensions of *B. abortus* protected against subsequent infection with *B. melitensis*."

The pathogenicity of *Bacterium abortus* and *B. melitensis* for monkeys; studies on the genus *Brucella* n. g., III, E. C. FLEISCHNER, M. VECKI, E. B.

SHAW. and K. F. MEYER (*Jour. Infect. Diseases*, 29 (1921), No. 6, pp. 663-698, figs. 4).—The authors find that virulent strains of *B. abortus* in sufficiently large dosage are pathogenic for monkeys. *B. melitensis* is far more invasive than *B. abortus*, one or two feedings of one-thousandth the amount necessary to cause an infection with *B. abortus* being sufficient in *B. melitensis* infection to parasitize a monkey.

Immunity in infectious abortion due to bactericidal materials, GLÖCKNER (*Deut. Tierärztl. Wchnschr.*, 29 (1921), No. 49, pp. 627-629).—Evidence is presented that the serum of cattle immunized by treatment with a commercial abortion bacterin Antektrol possesses specific bactericidal properties. The author concludes that immunity toward infectious abortion is due, in part at least, to the presence of bactericidal substances in the blood serum, and that the detection of such substances should serve as a diagnostic measure.

Special cattle fatality in the Maranoa district and its relation to the larvae of *Pterygophorus analis* Costa, H. TRYON (*Queensland Agr. Jour.*, 16 (1921), No. 3, pp. 208-216, figs. 7).—This is a report of observations of a sawfly the larvae of which cause the death of cattle which have developed an appetite for them. This peculiar fatality occurred in a considerable area of the Maranoa district in 1911, 1913, and 1914 in annually increasing extent. It is restricted to a definite area where the silver-leaved ironbark (*Eucalyptus melanophloia*), an especially favored food plant of the sawfly, grows and at the base of which the larvae congregate. This appetite of the cattle seems to be an abnormal one, since they feed upon the larvae principally when dead and decaying and even though there be plenty of grass about. The symptoms resemble those of a general toxæmia.

The so-called "staggers" or "pushing disease" of cattle in Natal, W. H. ANDREWS (*Jour. Compar. Path. and Ther.*, 34 (1921), No. 4, pp. 263-309).—This is a report of studies of an intoxication caused by the ingestion of *Matricaria nigellaefolia*, which belongs to the Compositae.

Bacillary dysentery in lambs, S. H. GAIGER and T. DALLING (*Jour. Compar. Path. and Ther.*, 34 (1921), No. 2, pp. 79-105, figs. 2).—This affection is already a serious menace to sheep raising and is annually spreading farther north in Scotland and farther south in England, only showing signs of abating where it has been in existence on a farm for seven or eight years. "The disease takes a heavy toll of life (30 per cent) among lambs, mainly during the first two weeks of life. Lambs over 15 or 18 days old are immune. The disease only appears each year with the lambs of susceptible age and disappears when these are all dead or have grown beyond the susceptible age. The disease is caused by a bacillus of the coli type which invades the body from the inflamed bowel. The lesions are inflammation and necrotic ulceration of the intestines. All the evidence goes to show that the ewe acts as a carrier of the bacillus and is responsible for carrying infection from season to season on the same land and also to other farms.

"A preventive serum was made and used on the lambs on the day of birth, but, while it undoubtedly immunized them, it did not give in all cases long enough protection to tide lambs over the susceptible age. Further tests with preventives will be made with the object of immunizing the lambs to carry them over the susceptible period of life. These will include the inoculation of pregnant ewes and of the new-born lambs. Much might be done to minimize losses by the precautions recommended for infected farms and by altering some of the present customs followed during lambing time."

On the etiology of pyo-septicæmia or joint-ill of lambs, N. JOHANSEN (*Über die Aetiologie der Lähme der Lämmer. Inaug. Diss., Tierärztl. Hochsch. Hannover, 1919, pp. 68*).—A review of previous investigations, with references

to a bibliography of 29 titles, is first presented. This is followed by a report upon the pathoanatomical findings in 15 lambs and of the liver of another, with descriptions of the bacteria detected.

In none of the animals was an inflammatory change found in the umbilical artery. In 11 of the lambs the umbilical vein was affected, and in all of these one or more other organs were also affected, there being abscesses in the liver in 9 and in the lungs in 6 and inflammation of the joints in 5 and of the umbilical cord in 2. An inflammation of the umbilical cord was found in the 2 lambs in which the cord was present and an inflammation of the joints in 8, and abscesses were found in the liver of 9 and in the lungs of 7. The spleen was enlarged in 5 cases. The organisms found present in the 16 cases are *Bacterium coli commune* in 8, *Staphylococcus pyogenes albus* in 6, *Streptococcus pyogenes* in 6, *Bacillus pyogenes* in 5, *Diplococcus* sp. in 3, *Bacterium pyocyaneum* in 3, *B. vulgare* in 2, *Bacillus teres* in 2, and *S. lanceolatus* in 2, and, in each of 8, other organisms were detected once each.

The eggs of the nematodirus worms of sheep, H. CRAWLEY (*Vet. Med.*, 16 (1921), No. 9, pp. 25-28, figs. 6).—A report of measurements of eggs of *Nematodirus* spp.

[Contagious mastitis (agalactia) in ewes and goats], H. CARRÉ (*Rev. Gén. Méd. Vét.*, 30 (1921), No. 351, pp. 131-135; *abs. in Jour. Compar. Path. and Ther.*, 34 (1921), No. 2, pp. 143, 144).—This account relates to a disease termed mal-de-lure that appeared among flocks in Vaucluse and Basses-Alpes in 1910.

The affected animals showed lesions of the mammary glands, eyes, and joints like those of agalactia, but differing in that intense suppuration occurred in all these lesions. The author's investigation resulted in the isolation from lesions of a bacillus quite distinct from the Preisz-Nocard bacillus. His later investigations indicate that the affection is caused by a filterable virus, and that the pyo-bacillus which causes the suppuration is only a secondary invader.

Hypoderma larvae in goats, H. E. CROSS and P. G. PATEL (*Punjab Dept. Agr., Vet. Bul.* 3 (1921), pp. 3, pl. 1).—An account is given of the attack of the goat by this parasite. In the Jhelum District it was found in the fall of 1920 to parasitize from 48.3 per cent in some flocks to 91.8 per cent in others, the number of larvae per goat varying from 6 to 30. It has been calculated by experts that one-fourth of the skins sent from India are depreciated in value from 50 to 70 per cent as the result of the damage done by these larvae.

The treatment of surra in camels by intravenous injections of tartar emetic, H. E. CROSS (*Punjab Dept. Agr., Vet. Bul.* 2 (1920), pp. 58, pls. 2, fig. 1).—In this detailed report of investigations conducted, of which an account has been previously noted (*E. S. R.*, 43, p. 584), the author reports that 46 camels which were treated for surra with tartar emetic have been returned to the military authorities for duty. The blood of these camels was examined daily for six months or more, and in some cases for over nine months after the treatments were finished, during which time no trypanosomes reappeared in the blood. Further, 1 cc. of blood from each animal was injected into rabbits, the blood of which was daily examined for 21 days without trypanosomes having been observed.

Pulmonary actinomycosis in swine, H. E. ALBISTON (*Jour. Compar. Path. and Ther.*, 34 (1921), No. 4, pp. 323-326, figs. 3).—This is an account of the pathological condition met with during an investigation of the etiology of frequently observed lung lesions in young swine after slaughter at abattoirs. Since the pigs were all young, from four to five months old—that is, at an age where milk plays a large part in their diet—the author thinks it quite probable that

the infection was introduced by feeding milk from cows whose udders were affected with actinomycosis.

On a form of swine fever occurring in British East Africa (Kenya Colony), R. E. MONTGOMERY (*Jour. Compar. Path. and Ther.*, 34 (1921), Nos. 3, pp. 159-191, figs. 2; 4, pp. 243-262, figs. 2).—This is an extended report of studies conducted at Nairobi of a form of hog cholera which the author considers due to a particularly virulent strain of the hog-cholera virus. Post-mortem appearances are said to be the same as occur in the common form.

Horse pox and coital exanthema J. F. CRAIG and D. KEHOE (*Jour. Compar. Path. and Ther.*, 34 (1921), No. 2, pp. 126-129).—The author reports upon an outbreak observed in April, 1920, in which one stallion and six mares were affected, which he thinks has some bearing upon the relation of these affections to each other.

Atlas of the anatomy and physiology of the dog, F. T. G. HOBBDAY and F. H. STANTON (London: Baillière, Tindall & Cox, 1921, pp. 24, pls. 5).—This work includes five original plates containing 43 figures, largely in colors, by G. Dupuy.

The differential diagnosis of diseases of the head of fowls, J. R. BEACH (*Poultry Sci.*, 1 (1921), No. 1, pp. 1-8).—This account includes 20 references to the literature.

Spirochaetosis of fowls, H. E. CROSS and K. SINGH (*Punjab Dept. Agr., Vet. Bul.* 2 (1921), pp. 5, pl. 1).—A brief account of this disease, which is very common in northern India and the mortality very high. The paper includes a brief account of the life history of *Argas persicus* and means for the control of this intermediate host. Ninety-five per cent of cures were obtained where soamin, or atoxyl, was administered subcutaneously or intramuscularly in the early stages of the disease. The dosage employed is 1 mg. of soamin in 1 cc. of water for chickens weighing 4 to 6 oz., and 8 to 10 mg. in 1 cc. of water or 2 mg. per pound of body weight for fowls weighing from 4 to 5 lbs. As a rule two injections have been found necessary, the second being given 24 hours after the first.

Practical experience in the control of coccidiosis in young chicks, T. B. CHARLES (*Poultry Sci.*, 1 (1921-22), No. 2, pp. 51-55).—An account is given of this disease, which was the source of large losses in Pennsylvania in 1921, and of means for its control.

Coccidiosis in rabbits and poultry (*Min. Agr. and Fisheries [London], Leaflet 364* (1921), pp. 7).—This is a summary of information.

RURAL ENGINEERING.

Chemistry for engineers and manufacturers, B. BLOUNT and A. G. BLOXAM (London: Charles Griffin & Co., Ltd., 1921, 4. ed., vol. 1, pp. XII+392, figs. 55).—The fourth edition of this book deals with the chemistry of engineering, building, and metallurgy, and is intended primarily for practicing engineers, managers of works, and technical students.

Part 1 deals with the chemistry of the chief materials of construction, of the sources of energy, of steam raising, and of lubricants and lubrication. Part 2 deals with metallurgy and metallurgical processes.

Proceedings of the thirty-third annual meeting, Iowa Engineering Society (*Iowa Engin. Soc. Proc.*, 33 (1921), pp. 208, pl. 1, figs. 10).—These proceedings contain articles of agricultural engineering interest on The Flow of Water in Drintile, by D. L. Yarnell; Determination of Maximum Run-off by Stream Gauging, by E. D. Burchard; Ditch Design and Prevention of Silt

Deposit, by Q. C. Ayres; Hydraulic Fill Dams and Levees, by S. M. Woodward; and Primary and Secondary Road Assessments, by F. W. Parrott.

Revenue report of the Government of Bihar and Orissa Public Works Department, Irrigation Branch, for the year 1919-20 (*Bihar and Orissa, Irrig. Branch, Rev. Rpt. 1919-20, pp. II+[149], pls. 11*).—This report includes data on revenues from and work and expenditures on irrigation projects in India during the year 1919-20.

Stream flow experiment at Wagon Wheel Gap, Colo., C. G. BATES and A. J. HENRY (*U. S. Mo. Weather Rev., Sup. 17 (1922) pp. 55, pls. 5, figs. 30*).—The object of this paper is to present a clear idea of the nature of the study to determine the influence of forests and vegetation upon run-off, the methods of study followed, the conditions observed to date, and the plan for the analysis of future findings. Data are given on the climate, precipitation, and stream flow of the area studied, the data on stream flow extending up to June 30, 1919. Later results are noted on page 738 of this issue.

The underground water resources of the Midlands, P. B. NYE (*Tasmania Dept. Mines, Underground Water Supply Paper 1 (1921), pp. X+142, pls. 7*).—This report deals with the underground water supplies of an area of about 500 square miles, comprising the greater part of the so-called Midlands of Tasmania. The district includes both low-lying and much elevated country and is more or less arid in climate.

A study of the economic geology of the area indicates that the sandstones and feldspathic sandstones are porous, but that the diabase is practically impervious. These two formations occur in equal amounts, and it is concluded that as a whole the Midlands is not a favorable area for underground water. The quality of the underground water was found to be generally suitable for all purposes. The quantity is sufficient to irrigate only about one-eighth of the available agricultural land.

A textbook of wood, H. STONE (*London: William Rider & Son, Ltd., 1921, pp. VII+240, pls. 42*).—This is a compilation of information on the physical, botanical, and structural characteristics and mechanical properties of wood.

Part 1 deals with details of the grosser structure and the surface, smell, taste, and contents. Part 2 deals with the tissues, the pores or vessels, the wood fibers and the rays, the soft tissue or parenchyma, and the pith. Part 3 deals with the mechanical properties of wood, resistance to strain, resonance and conductivity of sound, and absorption and shrinkage. Part 4 deals with figure, callus, defects, decay and durability, and laboratory practice.

The effect of moisture upon the strength of Douglas fir, H. D. HAYWARD (*Wash. Univ., Forest Club Ann., 9 (1921), pp. 19-25, figs. 2*).—Studies conducted at the University of Washington on the effect of moisture content upon the strength of Douglas fir are reported.

A freshly cut plank 3 by 12 in. in section and 16 ft. long was cut into six sections, each of which was ripped into five 2 by 2 in. sticks. These were weighed and oven dried to a moisture content of about 31.9 per cent. Determinations of the modulus of rupture and cross bending showed that when dried too rapidly wood casehardens. The dry shell formed resists evaporation of water from the interior and therefore allows strain on the interior fibers, often resulting in internal checking.

It was found that the loss in dimensions due to the decrease in volume of the wood during drying should not be overlooked, and that all measurements should be made immediately prior to tests. However, the loss in dimensions due to drying more than compensated for the gain in strength due to drying. Higher strength results were generally obtained on smaller test specimens than on large ones because of less internal checking and strain due to drying. The

fiber saturation point was found to average about 22.5 per cent in bending tests. It is concluded that differences in moisture content cause considerable variation in strength values for seasoned wood, but have no effect on green material. Any increase in strength of fiber obtained by drying large structural timber is as a rule offset by checking and other defects due to drying.

Wood block pavement after fifteen years of service, J. D. MACLEAN (*Pub. Works*, 51 (1921), No. 26, pp. 485-488, fig. 1).—In a contribution from the Forest Service, U. S. D. A., the results of a study of the relative wear of sections of pavement containing wood blocks made of Douglas fir, hemlock, longleaf pine, Norway pine, tamarack, western larch, and white birch are reported.

After 15 years it was found that the best results had been given by longleaf pine and birch, followed in order by eastern hemlock, tamarack, Norway pine, fir, and western larch. There was no evidence to show a difference in the rate of wear in blocks of different lengths. A comparison of the wearing qualities of blocks with and without sapwood did not show that the presence of sapwood was detrimental. Sections laid at 45 and at 67.5° did not show as much joint wear as the section laid at 90° with the curb. Blocks of wide and narrow rings seemed to withstand wear about equally well.

Relation between molded and core concrete specimens, H. S. MATTHEW (*Engin. News-Rec.*, 88 (1922), No. 2, p. 73).—Experiments conducted by the Pennsylvania State Highway Department are reported, which showed the general tendency toward considerably higher strengths in drilled cores from concrete roads than from molded test specimens of the same material and mixture. This is taken to indicate that the strength of the molded specimen is not a positively reliable indicator of the strength of the concrete in place in a road as determined by the drilled specimen.

Variety of movements occur in concrete test highway (*Engin. News-Rec.*, 87 (1921), No. 26, pp. 1048-1051, figs. 8).—The progress results of tests of the experimental concrete road at Pittsburg, Calif., are reported. These indicate (1) the occurrence of irregular longitudinal buckling or wave movements in the slabs, with contraction cracks at the crest of the waves, (2) warping of the pavement cross-section, varying with the time of day, the edges cupping up at night and curving down in the daytime, and (3) the occurrence of temperature differences of from 6 to 7° F. between the top and bottom of the pavement, the top being about 6° colder in the morning and 7° warmer in the afternoon. Another unexpected development was that at the end of four months of dry weather after the pavement was finished, the adobe subgrade under the center of the slab had a greater moisture content than when the work was started. Laboratory tests showed this content to average from 13 to 14 per cent by weight, and in one instance it was 27 per cent.

The measurements of deflection showed that the deflections increased as the traffic continued. The increase in the first week of 5-ton traffic was from 0.019 to 0.03 in.

Bacterial production of motor fuel, C. F. JURITZ (*So. African Jour. Indus.*, 4 (1921), No. 11, pp. 905-910, fig. 1).—In a contribution from the Department of Agriculture of the Union of South Africa, a review is given of different processes for the bacterial production of motor fuels containing alcohol and acetone.

It has been found that acetol, a fuel consisting of alcohol and acetylene gas, owes its properties largely to the fact that the addition of acetone to the alcohol increases the absorption of acetylene gas, thus increasing the volatility and calorific value of the mixture. In this connection attention is drawn to the production of alcohol from wastes such as corn cobs, pineapple refuse, and other organic materials by fermentation with certain organisms. It has been found

that certain organisms are able to produce alcohol and acetone direct from starchy substances.

Studies with *Bacillus acetoethylicum*, a new organism, yielded specially good results. In one case a sterilized mash of sweet potatoes yielded 18.6 gm. of alcohol and 5.1 gm. of acetone per 100 gm. of dry sweet potatoes.

Report of the lubricants and lubrication inquiry committee (*London: Dept. Sci. and Indus. Research, 1920, pp. 126, pls. 43*).—This report consists of an analysis of the problems involved in the field of research on the relation between viscosity of lubricants and the load on a bearing and the action of lubricants at high temperatures as applied to commercial methods of oil testing. As a result of this analysis, suggested schemes of research are presented which it is thought will lead to valuable results.

Twenty appendixes are included comprising the reports of the individual researches conducted upon which the main report is based. The apparatus and equipment used are described in detail, as well as the methods developed. The report is based largely upon the results obtained with the so-called Lanchester worm gear testing machine. This machine is capable of measuring the efficiency of transmission of power through the gear with an accuracy of 0.2 per cent by a direct measurement of the ratio of the torque in the worm shaft and the worm wheel shaft, respectively.

The values of the speed of the gear and the temperature of the oil under test were noted in every case. After acquiring the correct speed in any test the gear case was balanced and the ratio of the torques carefully observed. The balance was then maintained until a higher temperature of the oil was reached, when readings were again taken. This procedure was repeated, and if higher temperatures were necessary than those obtained after continuous running of the machine, heat was applied to the oil tank artificially.

In the case of all the mineral oils tested it was found that when a certain temperature of the oil was reached, called the critical temperature, the running of the gear became decidedly unsteady and a marked increase in the rate of the fall of efficiency with temperature was observed. Experiments beyond the critical temperature were continued until it was considered that the test could not be carried further without causing injury to the gear.

In the case of animal and vegetable oils, no critical stage was reached at temperatures below 75° C. (167° F.) Castor oil gave the highest efficiency at the particular load employed. With this lubricant the efficiency remained constant at 95.6 per cent at temperatures from 30° upward.

Rape and trotter oils were next to castor oil in order of merit. The efficiency was practically constant and equal to 95 per cent for both these oils. Sperm oil showed a gradual decrease in efficiency as the temperature rose, but appeared to attain a steady minimum value at 65°. The efficiency of sperm oil at normal temperature was as high as the best lubricant used, but fell off as the temperature rose. All the mineral oils tested showed the characteristic of a marked drop in efficiency at a particular temperature. The tests showed that there is an appreciable increase in efficiency (2 per cent) in raising the pressure from 0.5 to 2 tons per square inch, and there is an increase of efficiency in raising the speed of the worm shaft from 500 to 1,500 r. p. m.

The addition of rape oil in any proportion to mineral oils did not appear to increase the efficiency very appreciably (0.2 per cent was noted), but the critical temperature of the oil to which the addition of rape oil was made was raised. The raising of the critical temperature was obtained with the addition of as small a quantity of rape oil as 2.5 per cent, and increasing the quantity up to 25 per cent did not appear to make any further improvement.

Experiments were made to ascertain the effect of the addition to the oils under test of colloidal graphite in the form of oildag. In the case of animal and vegetable oils, the effect of the oildag on the oil was beneficial, but this was so small as to be hardly appreciable. In the case of mineral oils, beneficial results were found in four out of five samples, while in the case of the remaining sample no beneficial effect was observed. The results of these tests showed that the addition of colloidal graphite to some mineral oils (apparently inferior) may make them as efficient lubricants as superior mineral oils under the particular circumstances obtaining in the worm-gear test.

Further experiments were made by adding natural flaked graphite to the oils. The graphite used was of remarkable purity and very nearly free from mineral matter. In the case of animal oils there was an appreciable improvement in the efficiency due to the addition of flaked graphite, but in the case of vegetable oils no change was detected. With mineral oils, two samples were improved and two other samples were not affected. In no case did the addition of natural graphite produce a reduction in efficiency, but there was evidence that the wear on the gear was greater.

The various results obtained from tests with the Lanchester gear, considered in connection with the values of the viscosity of the oils employed and in connection with pressures of the order of those obtained in the gear in other studies, failed on comparison to reveal any evidence for the assumption that the frictional resistance of the gear is dependent on the viscosity of the lubricant alone. This was forcibly brought out in the comparison of the results for castor and trotter oils. At pressures of the order of those obtaining in the gear, the viscosity of castor oil at 40° was approximately six times that of trotter oil at the same temperature. In the tests, however, the frictional resistances were found to be approximately the same in both cases.

It was shown that the addition of deflocculated graphite to a mineral oil of relatively low lubricating value produces a marked improvement in its lubricating properties, whereas its addition to an oil of high lubricating quality produces very little effect. In this way it appeared possible to convert all the mineral oils tested into lubricants of approximately the same value for the class of gear in question.

What pulley tests have disclosed, W. D. HAMERSTADT (*Amer. Thresherman and Farm Power*, 24 (1921), No. 8, p. 6, figs. 3).—A brief summary is given of pulley tests conducted at Cornell University, in which a comparison was made of cast iron, wood, and paper. At 2 per cent belt slip the paper pulley transmitted 27.3 h. p., the wood pulley 12.35 h. p., and the iron pulley 10.8 h. p. Graphic data of these tests are included.

Housing the layers, M. A. JULL (In *Canadian Farm Poultry*. [Quebec]: Macdonald Col., 1920, pp. 56-72, figs. 21).—General information is given on the planning and construction of buildings for the housing of laying poultry under Canadian conditions.

Feeder and water stand for poultry, D. C. KENNARD (*Ohio Sta. Mo. Bul.*, 6 (1921), No. 11-12, pp. 176-179, figs. 3).—A feeder and watering stand intended to induce a greater consumption of water and dry mash by poultry is described and drawings given showing the important details.

Report of the subcommittee on rural sanitation, J. F. SKINNER, H. N. OGDEN, and J. C. DIGGS (*Amer. Jour. Pub. Health*, 11 (1921), No. 6, pp. 551-564, figs. 3).—This report consists of a bibliography, a statement of principles to be observed, type plans for sewage-disposal plants of various capacities, and recommendations for the aid of rural dwellers and public health officers. The principles outlined deal with the wastes to be treated, the choice of a system of

treatment, the basis of design, dimensions of units, sedimentation and digestion units, details of dosing devices, trickling filters, and subsoil irrigation.

Report on industrial wastes from the Stockyards and Packingtown in Chicago (*Chicago: Sanitary Dist., 1921, vol. 2, pp. 261, pls. 2, figs. 26*).—This report, made to the engineering committee of the Sanitary District of Chicago, deals with the experimental treatment of stockyards sewage in Chicago from 1915 to 1918, the purposes being to prevent pollution of watercourses and the eventual production of commercial fertilizers. The data so far indicate that the activated sludge method is practicable and will handle the waste from the entire packing and stockyards industry. The indications are that for many years tons of material have been thrown away as useless by the packers which might otherwise have been utilized in the form of fertilizer.

Sewage treatment in Imhoff tanks, R. RIKER (*Pub. Works, 52 (1922), Nos. 3, pp. 39-42; 4, pp. 59-62; 5, pp. 89-91; 6, pp. 106, 107, figs. 7*).—This report, a contribution from the Department of Health of New Jersey, summarizes experience with 37 Imhoff sewage tank installations in New Jersey, serving 33 municipalities, 5 institutions, and 3 corporations. The widths of the tanks designed in the State range from 12 to 35 ft., the lengths from 30 to 70 ft., and the depths from 12 to 30 ft. Experience in the State does not indicate that the advantages in operation gained by building deep tanks warrant the increased cost of construction. It is agreed that the same bacteriological action occurs in both the one-story and two-story tanks. Grit chambers should be installed previous to tank treatment, but it is stated that no satisfactory grease trap for use at the plant is available. Pumping the sewage has somewhat the same effect on the suspended matter as fine screens.

It is concluded that the promiscuous installation of Imhoff tanks should cease, and that careful consideration of all factors should precede a decision to use Imhoff tanks for settling purposes.

RURAL ECONOMICS AND SOCIOLOGY.

Research in farm economics and farm management, W. F. HANDSCHIN (*Jour. Farm Econ., 4 (1922), No. 1, pp. 1-12*).—It is said of cost of production studies that the application of the data resulting from them to a more scientific determination of prices remains largely to be made in the future. Investigations in the cost of distributing farm products are deemed important, especially in their application to the improvement of methods rather than in their value as a basis for price fixing or bargaining. Another phase of the marketing problem which should be carefully investigated is the form that farmers' collective marketing organizations shall take, whether cooperative or corporate. A comprehensive nation-wide study of land problems, and special studies, such as investigations of tenancy in the Corn Belt and Cotton Belt States, are recommended, together with the working out of some formula or principle for giving the proper weight to such factors in arriving at the objective or production valuation of farm land as the net income of the land after all expenses of production have been met and the prospective average annual increase in value. It is suggested further that new adjustments in cropping systems, combining soil maintenance, low cost per unit of product, and the largest possible measure of insurance through diversification and flexibility, are necessary.

State programs of work in farm management and farm economics (*Jour. Farm Econ., 3 (1921), No. 4, pp. 183-188; 4 (1922), No. 1, pp. 53-60*).—These pages present outlines of investigational projects in New York, reported by W. I. Myers; in Ontario, by H. C. Mason; in California, by R. L. Adams; in Iowa, by E. G. Nourse; in Indiana, by O. G. Lloyd; in Idaho, by B. Hunter; in

South Carolina, by W. C. Jensen; in Tennessee, by C. E. Allred; and in Wisconsin, by B. H. Hibbard.

The cost of horse labor, A. G. RUSTON (*Jour. Min. Agr. [London]*, 28 (1921), No. 9, pp. 810-816).—Records taken on 3 farms from 1908 to 1912 and on 6 farms from 1912 to 1914, also time sheets kept during 1919-20 on 11 farms, as a result of studies by the Department of Agriculture of the University of Leeds, are summarized. In 1919-20 on 11 farms whose total area amounted to 2,057 acres, 66 working horses were kept, and according to the time sheets they were engaged during that period in performing 14,278 days' work.

A tabulated summary of the costs is given. They were found to vary considerably from year to year and from month to month on the same farm during the same year and on different farms at the same time, according to the management of the horse labor. On the 16 farms whose accounts for the year 1920-21 have been completed, the cost of horse labor is said to have been found to vary from 4s. to 9s. 7d. per working day, with an average of 5s. 8d.

Some factors of success in Corn Belt farming, C. L. MEHARRY (*Jour. Farm Econ.*, 4 (1922), No. 1, pp. 13-24).—This paper gives specific treatment to problems of adjustment to changing economic conditions, diversification, the personal equation, and other factors in successful, large-scale farm operation in the Corn Belt.

A new agricultural policy, F. E. GREEN (*London: Leonard Parsons*, 1921, pp. 169).—A number of particular cases are cited which are considered to justify the conclusion that a great deal of land in Great Britain is mismanaged and that private enterprise can not be trusted to meet national needs. It is further asserted that private farming enterprise supervised by inspectors is also unsatisfactory. Certain disadvantages of farming on small holdings are pointed out in contrast with advantages claimed for farming by collective effort.

In suggesting an agricultural policy for Great Britain the author proposes an organization for agricultural production controlled by agricultural committees composed of farm laborers, farmers, economists, educators, and others. These committees would be coordinated into a national council of agriculture, controlling the land and the farming industry.

The relation of land tenure to the use of the arid grazing lands of the Southwestern States, E. O. WOORON (*U. S. Dept. Agr. Bul. 1001* (1922), pp. 72, pl. 1, figs. 5).—The business of raising stock on the arid grazing lands of the United States is said to be automatically limited by physical and natural factors; the resultant forage crop; and social and economic conditions, such as the laws and customs determining methods of land utilization, marketing conditions, and methods of financing the business. Plant and animal competition, soil moisture and erosion, poisonous plants, wild animals, watering places, and miscellaneous factors are described as some of the natural conditions governing this industry.

Characteristic plant associations found on grazing areas are noted, and a table of estimates of the areas of each found in Arizona and New Mexico is given.

The Government land policy is the one of the social and economic factors that is discussed in these pages. The Kinkaid, the enlarged homestead, and the grazing homestead acts have been passed in an attempt to provide proper land legislation for the dry lands of the West. Their effect has been, however, largely to put land out of use for a longer or shorter time, because the areas obtainable under each were not large enough for the profitable pursuit of the business which could be carried on upon the lands that were still available when the laws were passed. Three diagrammatic maps are given showing

the complicated condition of tenure that has resulted from the application of these land laws to a particular region and from grants to early colonists, the railroads, the State, etc.

The land of the arid grazing region is held as nine principal classes, over all of which, except the Government land that is open for entry, it is possible for the stockman to obtain legal control. The Government land is now so distributed that it is difficult to find areas of more than a few sections in solid blocks, and such blocks are usually so irregular in shape that the expense of fencing them is frequently prohibitive. All of these lands, except Government lands, have some kind of legal status that permits them to be fenced. If the inclosure of privately owned lands, however, would interfere with the possibility of any citizen's using the public lands, the fencing must be arranged so as to avoid this difficulty, and frequently this is impossible.

Numerous losses and drawbacks depending upon the open range system of management are described, as well as certain benefits arising from fencing the range and controlling its use.

Six general policies for meeting the problem of range control are discussed, of which the permit system is favored on account of its flexibility, because it is not incompatible with the State governments receiving a share of the rents equivalent to the taxes which would be collected on the land if it were in private ownership, because it need not interfere with a proper application of the homestead laws, because the right to prospect for and acquire mineral holdings might be granted without interfering with the administration of the grazing lands, and for other reasons.

Simplicity and economy in the transfer of land, A. C. MORRISON (*Scot. Jour. Agr.*, 4 (1921), No. 4, pp. 361-372).—A short survey of the history of feudalistic precedents for systems of land tenure and transfer in Scotland and views of certain reformers are given, with comment.

The author recommends that there should be introduced immediately a measure making it unlawful to create new estates of superiority; in other words, declaring that an owner of land shall no longer be entitled to convey his land in consideration of a perpetual feu duty, also that provision be made for the compulsory redemption of all feu duties within a period of perhaps 30 years. The sound view is said to be that all restrictive conditions after the redemption period are matters of public concern and should pass to the control of a public tribunal.

Tenancy on coconut holdings in the municipality of Loco, Province of Romblon, E. D. HESTER and G. M. MIÑANO (*Philippine Agr.*, 10 (1921), No. 4, pp. 145-168).—This paper reports upon a survey of tenancy conditions obtained on coconut plantings in the Philippines during the period from April 15 to June 2, 1920, including 96 representative holdings. A questionnaire was filled out by the investigator after a personal interview with the operator.

Of the holdings surveyed, 41.7 per cent fell within the size groups including those from 1.51 to 3 hectares. The average size of tenant holdings was 4.32 hectares (10.71 acres). The length of tenancy was comparatively short, the average being 53.5 months. The primary crops grown were coconuts, rice, and corn. Land ownership among the tenants was found to be insignificant, and there was no indication that tenancy in this municipality leads to ownership. Further, there was no indication that a permanent peon class exists involving a general inheritance of holdings. About two-thirds as many tenants were related to the landlord as were related to the former tenant of the same holding.

Discussion is given of the terms of contract regarding coconuts, rice, corn, and secondary crops, dealing with the arrangements for cultivation and division

of profits of each of these crops. Five types of coconut contracts, which together included 59 of the 96 units surveyed, are discussed.

Farm mortgage loans by banks, insurance companies, and other agencies, V. N. VALGREN and E. E. ENGELBERT (*U. S. Dept. Agr. Bul. 1047 (1921), pp. 23, fig. 1*).—A study was made by means of questionnaires and correspondence with the object of ascertaining the amount of farm credit available from various sources, the cost of such credit to the farmer, the term for which loans are available, and the method of repayment provided for. The facts relating to farm mortgage credit as disclosed by it are condensed in these pages.

Five sources of loans, including life insurance companies, Federal land banks, State funds, or agencies, and farm mortgage bankers, accounting for about 40 per cent of the farm mortgage credit as indicated by the estimated mortgage debt, are briefly discussed. It is suggested that former owners and private investors constitute two of the most important sources for which no figures are available.

Table 1 in this bulletin represents actually reported figures for estimated amount and partial sources of farm mortgage loans in 1920, by States; table 2, the number of banks replying to the questionnaire and amount of loans actually reported; table 3, the estimated amount and percentage of loans held by banks, December 31, 1920, classified according to first and second mortgage; and tables 4 and 5, the average current rates of interest in March, 1921.

The total farm mortgage debt, indicated by the estimated figures in table 1, constitutes 12.9 per cent of the total farm values in the United States. The commercial banks holding farm mortgage loans amounting to \$1,447,500,000, are of first importance, while life insurance companies rank second as sources of such loans.

Bank loans to farmers on personal and collateral security, V. N. VALGREN and E. E. ENGELBERT (*U. S. Dept. Agr. Bul. 1048 (1922), pp. 26, figs. 2*).—Certain of the results of an inquiry (see above) sent recently to all banks in the United States are summarized in these pages. Forty-five per cent of the banks in the United States complied with the request for information.

In table 1 is found the reported amount of bank loans to farmers on personal and collateral security, as well as the estimated total amount of such loans outstanding for all banks on December 31, 1920. It is observed that for short-time or personal credit, farmers rely mainly on commercial banks, estimated loans from this source amounting to \$3,869,891,415 at the close of 1920.

For the United States as a whole, 76 per cent of the banks reporting had some farm business. In the West South Central States, the corresponding figure was 88 per cent, and that for the New England States 45 per cent. Five States showing the highest percentages were Arkansas 95 per cent, Oklahoma and Montana 92 per cent each, and Kansas and North Dakota 91 per cent each. The three States showing highest percentages which personal and collateral loans to farmers were of total loans and discounts at banks were South Dakota, North Dakota, and Kansas, for which the figures were 67.98, 62.58, and 60.07 per cent, respectively.

A figure illustrates for the United States and for each of its geographic divisions the fluctuations in the amount of farmers' personal and collateral loans outstanding with reporting banks during 1920.

Average, low, high, and prevailing rates of interest on short-time loans of \$100 or more and on petty loans to farmers reported by banks, March, 1921, are tabulated by geographic division, State, and crop estimates district. Considerable sectional variations in interest rates are indicated for reasons which have been previously noted (*E. S. R.*, 35, p. 891).

It is noted that some banks require that a certain portion of the loan be kept permanently on deposit so long as the loan exists. Six per cent of the banks reported a minimum balance requirement on 16.3 per cent of their loans. It seems probable that this practice has resulted from the mistake of establishing by law a maximum rate of interest which is lower than is justified by the available supply of capital in relation to demand. Forty per cent of the banks follow the practice of collecting the interest at the time the loan is made on 66 per cent of their loans to farmers on personal and collateral security. This is most common in the eastern and southern sections, and occurs only rarely in the Central or Western States.

In regard to the nature of the security offered, this inquiry brought out the fact, for the country as a whole, that 36 per cent of farmers' short-time loans had no security other than the written promise of the debtor to pay. In Iowa 66.3 per cent of such loans were of this nature. In Rhode Island 97.5 per cent were loans secured by the indorsement of one or more persons, as were also two-thirds or more of those in Vermont, Connecticut, New Jersey, and Pennsylvania. In the West South Central and Mountain States, mortgages on live stock are particularly common.

For the United States as a whole, the average term of loans falls between 3 and 6 months. About one-fourth run for six months or more. In the Eastern States more loans are made for a term of three months or less.

Crop insurance: Risks, losses, and principles of protection, V. N. VALGREN (*U. S. Dept. Agr. Bul. 1043 (1922), pp. 27, fig. 1*).—The terms "loss" or "damage" in connection with growing crops are defined. A crop exceeding by 10 per cent the normal yield, or the one that the crop reporter has in mind as actually occurring in good years over an extended area and in percentages of which he reports crops prospects as well as crop damages from different causes, is said to be a perfect or no-damage crop. The relative degree of severity of different crop hazards with reference to each of several crops enumerated for the country as a whole and for various geographic divisions, as well as quantitative losses in various years and periods of years, are indicated from tabulated statistics given. Applying average farm prices to the quantitative losses of each crop for each year, this total annual crop damage in the United States to the crops here considered varied during the years 1909 to 1919, inclusive, from \$2,054,000,000 in 1912 to about \$3,066,000,000 in 1918. The average annual crop damage during the period was \$2,620,000,000.

The importance of such measures of self-insurance as diversification, seed selection, and savings are noted, but it is pointed out that there remains a large element of risk in the production of crops which can be adequately cared for only by insurance in the technical sense of the word. A few plans of hail, fire, and general crop insurance are outlined. The following principles are emphasized as fundamental to a sound plan for crop insurance:

- (1) The insurance must cover only such crop damage as will result in serious financial loss to the farmer.
- (2) It must cover any and all hazards which are beyond the farmer's control.
- (3) In no case must it protect against loss from carelessness or negligence on the part of the insured.
- (4) The premium, or cost of insurance, must bear a reasonable relationship to the value of the protection that it purchases.
- (5) The method of adjusting loss must be such that the insured will receive indemnity for crop damage in the amount or on the basis that he is led to expect from the figures indicating the amount of insurance an acre.
- (6) An early adjustment should be provided for in case of total failure of an insured crop, or such an approximation to failure that it would not pay to mature and harvest the crop.
- (7) All adjustments involving only partial

damage should, so far as possible, be left until after the crop has been harvested and put into marketable form so that quantity and grade can be determined. (8) The insured should find some method of helping the organization providing protection to reduce the heavy expense connected with the acquisition of business which now prevails in nearly all lines of insurance, at any rate where the business is conducted on a commercial basis.

A method of insuring crops, H. A. WALLACE (*Wallaces' Farmer*, 47 (1922), No. 9, p. 293).—This article describes a method of crop insurance involving the principle that the farmer who has insured his crop is not entitled to compensation for crop damage unless his has been damaged more seriously than the crop of the country at large. It is attempted to work out a fair premium on the basis of the corn yields in a certain number of districts over a period of years, apportioning them so that the farmers in each district would get back as much money as they had put in, less the cost of administering the insurance system.

The rural industries round Oxford, K. S. WOODS (*Oxford, Eng.: Clarendon Press, 1921, pp. 180*).—The study summarized in these chapters was undertaken by the Institute for Research in Agricultural Economics at the University of Oxford. The investigation covered the period from March, 1919, through March, 1920, including an area which lies within a radius of 30 miles from the city of Oxford, a region fairly typical of agricultural England. The main object was to ascertain what rural industries existed, the reasons for their localization, their present position, and the prospects for future development. They are classified in six groups, namely, those industries which owe their existence mainly to local material or to the needs of the local market, those which depend upon the local supply of labor or the supply of water, a few almost extinct as rural industries, and industries revived or recently started.

Part 1 covers the economics of rural industries, conditions governing them, and their place in the rural economy. It is said that they have declined because they have had to meet competition with large-scale production and because of lack of facilities for obtaining market information and education and training for the workers. They have in some cases survived where special facilities exist with regard to proximity of material, market, or labor supply. It is suggested that since they have a value on economic and social grounds, some steps should be taken to guard against the dangers which beset them. The means suggested are organization of the workers and efficiency in the production and distribution of products. It is urged that education be provided through the State schools, through provisions for apprentices and learners, societies for promoting adult education, and home training.

Detailed reports are given in part 2 of woodland industries, basket making, and glove making.

Wheat production in New Zealand, D. B. COPLAND (*Auckland, N. Z., Melbourne, and London: Whitcombe & Tombs, Ltd., [1920], pp. XX+311, figs. 17*).—Soil and climatic conditions in New Zealand are said to be specially suited to wheat production, although isolation, difficulties with harvesting and labor, and the small annual output counteract the advantages somewhat. Soft wheat is almost universally grown. In relating the history of wheat production in the islands, several definite cycles are pointed out, as well as the general tendency to inverse correlation between supply and price and the competition between sheep and dairy farming and wheat growing, which has caused an appreciable decline in the latter. Copious treatment is given to prices, cost of production, and related topics. It is concluded that wheat production will remain one of the primary industries of the country, but will be confined to the Provinces in which it is now most largely carried on.

A chapter on improvement by selection is noted elsewhere. Appendixes contain tabulated statistics and explanations of statistical methods used throughout the study. A bibliography, including books and other publications on economic theory, the early history of New Zealand, and general agriculture and statistical reports, is included.

The States of South America, C. DOMVILLE-FIFE (*New York: Macmillan Co., 1920, pp. XVIII+287, pls. 34*).—The author attempts to give a concise description of each country and its principal cities, together with a condensed account of geographical, topographical, agricultural, industrial, and commercial features.

The community, E. C. LINDEMAN (*New York: Assoc. Press, 1921, pp. IX+222*).—After introductory chapters on the social nature of man, the neighborhood and the community, community institutions and their functions, the vital-interest group, and types of communities, the author discusses the community movement in relation to the theory of democracy, distinguishing between the community movement as a social force and community organization as a phase of the social process. Numerous manifestations of the movement are described as attempts to restore the authority to smaller groups. Community needs are classified as orderliness, economic well-being, physical well-being, intellectual diffusion, associative ties, ethical control, recreative exercise, spiritual motivation, philanthropy, and group articulation. Government and voluntary agencies based on these needs are discussed.

The community in the functional sense is said to be an association of groups which give direction and policy to community action. Ten sociological and psychological steps in community action are outlined and discussed in detail. The direct theory of community organization is said to be that in which the group adherence of the individual is minimized, and in which he is considered to be related to the community organization as an individual and by right of his citizenship. The indirect theory regards the adherence of the individual primarily to a vital-interest group. The compound utilizes both conceptions. Arguments for and against each are presented, together with examples. Ten principles for community organizations are then suggested. The last chapter is devoted to setting forth the qualities of Christian leadership.

Weather, Crops, and Markets (*U. S. Dept. Agr., Weather, Crops, and Markets, 1 (1922), Nos. 5, pp. 89-104, figs. 2; 6, pp. 105-128, figs. 5; 7, pp. 129-152, figs. 2; 8, pp. 153-176, figs. 2*).—These numbers offer current weekly reviews of weather conditions with charts indicating the departure of mean temperature from the normal and precipitation in inches. Statistical information relative to the receipts and prices of important classes of agricultural products is given, with special articles on particular commodities or outstanding market situations. No. 7 includes the usual estimates of farm value of important products, as of January 15, and the average of prices received by producers of the United States.

Farmers' Market Bulletin (*North Carolina Sta., Farmers' Market Bul., 9 (1922), No. 48, pp. 9*).—A partial list of products which farmers have for sale is given as in preceding numbers. A statement regarding the farmer's short-time credit difficulties and the opportunity for cooperative action provided by the North Carolina Credit Union law is included.

AGRICULTURAL EDUCATION.

The curriculum of the college of agriculture, C. R. WOODWARD (*U. S. Bur. Ed. Bul. 40 (1920), pp. 86, figs. 10*).—This paper presents a study of the regular four-year course in agriculture leading to the bachelor's degree in the land-grant colleges of the United States, undertaken in order to determine some of

the fundamental principles on which the course should be based. The data were compiled from the catalogues of the colleges and answers to a questionnaire submitted to the deans of the respective colleges. Information gathered from the catalogues is set forth in part 1.

Table 1 shows the number of colleges requiring each subject in any given year; table 2, the colleges offering each subject as an optional each year. The number requiring each subject at any given time during the course was calculated and is shown in diagram 1. It appears that only two subjects, English and inorganic chemistry, were required in all the 47 colleges for which data were recorded (the Utah College being omitted because it has a group elective system for all four years). Botany, animal husbandry, zoology, physics and soils, and dairy husbandry ranked next in order of the number of colleges in which they are required. Organic chemistry, bacteriology, qualitative chemistry, and trigonometry were required in 24 or more colleges. On the other hand, it is found that sociology, agricultural mathematics, forestry, landscape horticulture, farm buildings, and general agriculture are the subjects with a small number of units to their credit.

Other detailed tabulations are made of the distribution of the required subjects throughout the four years of the course and with respect to the number of hours a week and the number of semesters. A study is also reported of the distribution and variation of the academic, scientific, general agriculture, special agriculture, and elective types of work throughout the four years.

A summary of methods of specialization shows that 37 colleges begin specialization in the third year, while 5 of the remainder start in the second year, and 6 in the fourth. It is said to be generally acknowledged that the junior year is the proper time for specialization to begin. Methods of offering specialization are classified into the departmental group elective, the major option, and the free elective groups.

It was disclosed that a majority of the 48 colleges require some farm practice, varying as to the amount between 6 months, 3 months, 1 year, and 6 weeks. Only 3 of the 25 reporting this requirement stipulate that it be taken under the direct supervision of the college. Most of them allow no academic credit for this practice work.

The questionnaires summarized in part 2 were sent out early in April, 1919, and 35 replies were received. Some of the recommendations are as follows: The distribution of types of work should be on the basis of academic 21 per cent, scientific 27, general agriculture 26, special agriculture 14, total agriculture 40, and elective 12 per cent. The proportion of required work should be about 62 per cent, that of prescribed elective 26, and free elective 12 per cent. The best method of offering specialization is the departmental group. A minimum of six months of farm practice, completed before the fourth year, preferably before the third year, and better still before matriculation, should be applied. Foreign language should be required only of students who have not had at least two years thereof in preparatory school and of those who are preparing for teaching or research.

The distribution of studies in a degree course in agriculture, R. NEWTON (*West. Canad. Soc. Agron. Proc.*, 1 (1920), No. 1, pp. 13-16).—It is held that the degree course in agriculture should be primarily for the training of teachers, investigators, and extension workers. Four groups of studies are designated as point of view, fundamental science, prerequisite, and advanced courses, the first two of which should be given in the first and second years, prerequisite courses in the third year, and advanced courses in the fourth. An outline of the proposed arrangement is given.

The scope and arrangement of studies in the degree course in agronomy, T. J. HARRISON (*West. Canad. Soc. Agron. Proc.*, 1 (1920), No. 1, pp. 3-12).—It is suggested that in a course in agriculture of 150 credits about 30 should be devoted to agronomy, particularly so far as colleges in western Canada are concerned. The scope of studies in cereal and forage crops, soils, and miscellaneous related subjects, as well as the time allotted to each, is outlined.

Successful teaching in rural schools, M. S. PITTMAN (*New York: Amer. Book Co.*, 1922, pp. 294, figs. 19).—A teacher in a one-room school writes letters to a friend about the problems she meets, such as school tests, teachers' meetings, discipline, the presentation of various school subjects, community teamwork, the project method, school hygiene, and rural supervision. Questions for study and a list of references are included with each chapter.

"Rural bias" in secondary schools: The work at Sexey's Foundation School in Somerset, S. L. BENSUSAN (*Jour. Min. Agr. [London]*, 28 (1921), No. 2, pp. 143-149, pl. 1).—A coeducational secondary school in Somerset, England, is described. The ordinary course in agriculture is open to boys and girls between the ages of 15 and 17 who have reached the fifth form. In addition to farm bookkeeping based on the year's accounts of the school farm, the course of study includes land measurement and surveying, the theory and practice of dairying, the feeding and care of live stock, and the principles of land cultivation and manuring on grass land, arable land, and moor. Demonstrations in orchard care and management are carried on. The course for girls includes all branches of dairy work, bookkeeping, correspondence, poultry keeping, and a study of foods and feeding, together with practical gardening, fruit culture, fruit storage, and preservation.

The Southeastern Agricultural College, Wye, M. J. R. DUNSTAN (*Jour. Min. Agr. [London]*, 28 (1921), No. 6, pp. 516-520).—This institution, originally a monastic educational college, started as an agricultural college in 1894 with 13 students, having now 205 in residence. Three college courses are offered. Part of the instruction is given by means of practical classes on the farms, which consist of about 450 acres, 390 of which are devoted to agriculture, and the remainder being given up to fruit, hops, poultry, market gardening, and forestry. An experiment has been made during the past year in putting the farm entirely under the charge of a committee of practical farmers. The policy of the college is to give instruction in agriculture and horticulture to the future cultivator, to train the scientific expert, and to offer opportunities to postgraduate students for specializing in some line of investigation.

Progress report of the Imperial Forest College, Dehra Dun, from July 1, 1920, to March 31, 1921, W. F. PERRÉE (*Imp. Forest Col., Dehra Dun, Prog. Rpt.*, 1920-21, pp. [2]+28).—This sets forth the enrollment, qualifications of students, and other information, as well as the courses offered and results of final examinations.

Courses in soils in Smith-Hughes schools and their relation to college courses, M. F. MILLER (*School and Soc.*, 14 (1921), No. 362, pp. 513-515).—It is said that there is no doubt that the complexity of the subject matter of soils offers a very great obstacle to successful teaching in vocational schools. Such a course is frequently combined with that of field crops. It is suggested that in view of the importance of the subject of soils the ideal plan is a unit's work given along with a unit's work in field crops, preferably in the first or second years of the course in agriculture. The instruction should be different so far as the subject matter itself is concerned, although in field practicums and home projects the two subjects should supplement each other.

As to the way in which the colleges may avoid duplication, it is suggested that they may improve and advance the character of the technical agriculture given, or they may require students to take more advanced courses in the subjects concerned. By adopting the standard beginning course, as recently adopted at a conference of soil instructors, the colleges need not be concerned over duplication.

The natural sciences as a basis for household science, O. KNISCHEWSKY (*Jahresber. Ver. Angew. Bot.*, 14 (1916), No. 1, pp. 32-38).—The author briefly describes methods of presentation of elementary botany, physics, chemistry, and general physiology to students at the school for home and farm management at Bad Weilbach, near Florsheim, in Hesse. The importance of training in household management, based upon these fundamental sciences and including practice in cooking methods as well as knowledge of foods and nutrition, is pointed out.

Round table, committee on teaching (*Jour. Home Econ.*, 13 (1921), No. 9, pp. 424-429).—Brief discussions were heard on the subject of coordinating home economics instruction with home life experience. Papers were read on Teaching Foods in Rural Schools, by C. Harris; and Problems in Continuation Classes, by E. Miller.

[Proceedings of the extension section] (*Jour. Home Econ.*, 13 (1921), No. 9, pp. 415-424).—Brief discussions for this section of the fourteenth annual meeting of the American Home Economics Association, June 28, 1921, were submitted by M. Ambrose and M. Sayles on Reasons for Rapid Development of Home Demonstration Work, and by E. Trabue and J. S. McKimmon on How Club Work Prepares Girls for Earning a Livelihood as well as for Womanhood. An outline of advanced plans for the 1921 home demonstration program was given by I. S. Harrington. Recommendations of the committee on extension needs and maintenance were submitted by G. E. Frysinger.

Successful family life on the moderate income, M. H. ABEL (*Philadelphia and London: J. B. Lippincott Co.*, 1921, pp. XII+251).—This book is adapted to use in home economics courses in schools and colleges. The advantages of a fair start in home building and of living on a budget, the value of the woman's contribution as a home manager, and the cooperation of the community in providing recreation and certain satisfactions of life are under survey, with the object of determining the factors of success in its best sense.

The paper dress form (*U. S. Dept. Agr., Dept. Circ.* 207 (1922), pp. 10, figs. 9).—Instructions are given for making the gummed paper dress form recommended by home demonstration agents as a time-saving and labor-saving device for use in home dressmaking.

Elementary clothing project (*Ky. Agr. Col. Ext. Circ.* 116 (1922), pp. 31, figs. 14).—Sewing projects to follow the beginning course (*E. S. R.*, 46, p. 697) are outlined.

The school lunch (*Ohio Agri. Col. Ext. Bul.*, 17 (1921-22), No. 4, pp. 16, figs. 5).—Suggestions are made to teachers in rural schools with regard to the body needs of the growing child, the best foods for the lunch carried from home, the equipment and supplies needed for serving hot lunch at school, and recipes for a hot dish to be prepared at school.

The working of a federation of women's institutes: Dorset, B. LEES (*Jour. Min. Agr. [London]*, 28 (1921), No. 6, pp. 543-547).—Details of the organization of the Federation of Women's Institutes in Dorset County, England, are given, together with an account of training in home crafts and other branches.

Vocational rehabilitation in rural communities, C. HENRY (*Fed. Bd. Vocat. Ed. Bul.* 72 (1922), pp. V+13, figs. 4).—The purpose of this bulletin is to enlist the assistance of county agricultural agents, agricultural teachers, and other rural workers and agencies in reporting to the State rehabilitation service such cases as seem probably eligible for vocational rehabilitation. Some examples are given which indicate the scope of the State service and its accomplishments. An appendix gives a digest of the Federal act providing for the vocational rehabilitation of disabled civilians.

Report of the superintendent of extension, W. J. GREEN (*Guam Sta. Rpt.* 1920, pp. 65-77, pls. 2).—Boys' and girls' club work is said to be somewhat more popular in Guam than either adult demonstration work or school gardens, the work with adults being more difficult to establish and requiring close personal supervision. Brief reports are made on extension work with crops, farm implements, live stock and poultry, and tick eradication, and on fairs, school gardens, and corn, bean, copra, taro, pig, and poultry clubs. The largest enrollment is recorded in the poultry club work. Brief suggestions are made as to the way in which club work may be correlated with school work, especially in the study of English and arithmetic.

Boys' and girls' agricultural clubs, J. W. DEEM (*New Zeal. Jour. Agr.*, 23 (1921), No. 1, pp. 36-40).—It is said that operations in the South Taranaki district in New Zealand during the season of 1920-21 were confined to the swede and mangold clubs, 82 competitors out of the 140 entries for mangolds and 20 of the 53 entries for swedes completing the projects and having their crops judged. Records for competing schools, groups of schools, and districts are given, as well as the scale of points used in judging and other reports.

MISCELLANEOUS.

Report of the Guam Station, 1920, C. W. EDWARDS ET AL. (*Guam Sta. Rpt.* 1920, pp. 79, pls. 8).—This contains reports of the animal husbandman in charge, the agronomist and horticulturist, and the superintendent of extension, and meteorological observations. The experimental work recorded is for the most part abstracted elsewhere in this issue.

Thirty-fourth Annual Report of South Carolina Station, 1921, H. W. BARRE (*South Carolina Sta. Rpt.* 1921, pp. 55, figs. 19).—This contains the organization list, a financial statement for the fiscal year ended June 30, 1921, and a report on the work and publications of the station during the year. The experimental features reported are for the most part abstracted elsewhere in this issue.

The work of the Huntley Reclamation Project Experiment Farm in 1920, D. HANSEN (*U. S. Dept. Agr., Dept. Circ.* 204 (1921), pp. 31, figs. 3).—This report includes a discussion of agricultural conditions on this project and the extent and character of the work carried on during the year at this farm, located near Osborn, Mont. The experimental work reported is for the most part abstracted elsewhere in this issue. Data are also summarized as to acreage, yields, and farm values of crops produced on the project and the number of live stock.

Monthly Bulletin of the Ohio Experiment Station (*Ohio Sta. Mo. Bul.*, 6 (1921), No. 11-12, pp. 161-191, figs. 13).—This number contains, in addition to several articles abstracted elsewhere in this issue, an index to volume 6.

NOTES.

California University.—A new campus plan which has been adopted by the board of regents to govern the future growth of the branch of the college of agriculture at Davis has just been completed by the department of landscape gardening. The plan itself is approximately 5 by 7 feet in size and rendered in color to bring out the details of the main scheme. The detailed arrangement of buildings is such as to form eventually group units with secondary quadrangles, as called for by the style of architecture which is to prevail. Both esthetic considerations and such utilitarian factors as convenience, accessibility, centralization of special and general types of instruction and research, comfort, and health have been considered in the study and preparation of the plan. Already two new buildings, the dairy industries and the horticultural building, are being erected under its provisions, and new sidewalks, curbs, and roads are under construction, with the result that it is already beginning to show definite results and furnish a visible suggestion of the future institution.

Connecticut Stations.—Edward C. Schneider of Wesleyan University has been appointed to the board of control of the State Station to fill the vacancy caused by the resignation of W. H. Hall of South Willington.

H. D. Edmond, chemist at the State Station since 1909 and to both stations since 1918, died April 14 at the age of 43 years. He was a graduate of the Connecticut College in 1904 and taught various subjects at the college for the ensuing five years. His experimental work included studies of the incubation of hens' eggs with reference to respiration and the rôle of carbon dioxide in respiration and, together with D. C. Warner, of blood fat in relation to egg production.

Illinois University and Station.—Herbert W. Mumford, head of the animal husbandry department, has been appointed dean of the college of agriculture and director of the station to succeed Dean Davenport, whose retirement on September 1 has been previously noted.

Purdue University.—Plans for a new recitation building, 170 by 75 feet and to cost about \$150,000, have been approved, and construction is under way with a view to completion next fall. This will be the second building to be erected under the enlarged building plan adopted last year and will house the departments of history, economics, education, and mathematics.

Iowa College and Station.—M. T. Jenkins of the U. S. Department of Agriculture has been detailed to the station for cereal breeding experiments on the relative value of the pure line theory of selecting new varieties of corn. It is expected to run tests on 500 ears of 10 common Iowa varieties and to inbreed them, using the corn obtained in further crossing.

A new department of genetics has been established in charge of Dr. E. W. Lindstrom, assistant professor of genetics in the University of Wisconsin and assistant in genetics in the station.

Kansas College and Station.—The State board of agriculture held its April quarterly meeting at the station, devoting two half-days to a study of some

of the experimental projects. In each instance the project leaders explained to the board the objects and methods of procedure of the experiment, its relation to the agriculture of the State and Nation, and something of the results so far secured and their significance.

A short course for the dairy herdsmen of the State institutions was held at the college during the week beginning March 6. The dairy herds at 15 of these institutions are under the advisory supervision of the head of the dairy husbandry department of the college, and these institutions were represented at the course by either the dairy herdsmen or the institutions' superintendents.

The bi-weekly luncheons of the station staff, instituted four years ago, have attracted an average attendance the past season of about 70. These luncheons are held from November to April, inclusive. At each luncheon any new additions to the staff are introduced, and some member gives a brief discussion of some feature of research work he is carrying on.

Maine University and Station.—Dr. Clarence C. Little, since 1918 research associate at the Long Island Station for Experimental Evolution of the Carnegie Institution, has been appointed president of the university, the inauguration taking place May 10.

E. Raymond Ring has resigned as superintendent of Aroostook Farm to accept a similar position with the Rockefeller Institute at Princeton, N. J., and will be succeeded by Perley Downing.

Mississippi Station.—The total State appropriations for the ensuing biennium aggregate \$165,200. This includes \$50,000 for the main station, an increase of \$5,200; \$30,600 each for the McNeill and Holly Springs Substations; \$34,000 for the Delta Substation; and \$20,000 for the Raymond Substation, an increase of \$10,000.

Missouri University.—Plans have been practically completed for the new agricultural building for which \$200,000 was appropriated by the last legislature. This building will constitute the center of the agricultural group, including the present agricultural and horticultural buildings, and will serve as the administration headquarters of the college of agriculture.

The building will also provide space for the departments of soil survey, rural economics, farm management, and rural sociology, the poultry department, the agricultural editor, a room for entomological collections, a plant room for the use of the department of horticulture, several classrooms, and special facilities for the college library. Another feature will be the provision of vault space for each department for the preservation of station records and similar data.

Montana Station.—Paul F. Sharp, a candidate for the Ph. D. degree in chemistry from the University of Minnesota this spring, has been appointed assistant chemist beginning July 1, to succeed Dr. M. J. Blish, whose resignation has been previously noted. Ray E. Kellogg, a 1922 graduate of the Kansas College, has been appointed assistant in the grain laboratory, vice W. Friend Day, who resigned March 1.

New Jersey College and Stations.—The 1922 legislature appropriated \$150,000 for the erection of a dairy and animal husbandry building, and \$20,000 for the equipment of the new poultry husbandry building, which is expected to be ready for occupancy by September 1. The total appropriations for the college, including the College for Women, amounted to \$521,200.

The stations also received substantial appropriations, \$78,000 being granted for salaries and expenses in the departments of horticulture, dairy husbandry, animal husbandry, agronomy, farm management, and general administration. For printing bulletins, circulars, and other publications, \$15,000 was appropriated. Mosquito control received \$18,000, oyster investigation \$1,600, seed

inspection \$7,500, experimental work in vegetable production \$3,000, insecticide inspection \$1,000, farm demonstration and other extension activities \$65,000, cranberry investigations \$5,000, investigations in diseases of white potatoes, sweet potatoes, and tomatoes \$12,000, legume inoculant inspection \$2,000, poultry husbandry maintenance \$17,000, egg-laying and breeding contests in Cumberland and Bergen Counties \$10,000, poultry exhibits and premiums \$6,000, creamery inspection \$3,000, sewage investigation \$5,000, and repairs on the station buildings \$850.

New York State Station.—It is proposed to extend the studies under way for many years with tree fruit varieties to small fruits. Much work has already been done at the station in breeding and selecting improved strains, but the proposed investigation is expected to be much more comprehensive than anything previously attempted, in that an effort will be made to plant all known varieties of small fruits that are likely to prove hardy under New York conditions. An examination of nursery catalogues from all parts of the country revealed the fact that several hundred varieties of the different small fruits have been listed, including 30 of currants, 25 of gooseberries, 27 of black raspberries, 44 of red raspberries, 8 of purple raspberries, 67 of blackberries and dewberries, 25 of everbearing strawberries, and 200 of June-ripening strawberries. Stocks of many of these varieties are being set out on the station grounds this spring.

The station is conducting experiments to determine whether it is possible to control the pear psylla by attacking it in the adult stage with nicotin either in the dust or spray. The results to date indicate that the adult flies are extremely susceptible to nicotin, even in small amounts, especially during the summer months when the temperatures are high. On individual trees sprayed or dusted with nicotin preparations the pear psylla adults appeared to be completely exterminated, although the practicability of freeing an entire orchard in this manner has not yet been demonstrated in actual field practice.

Richard F. Keeler, associate in research (chemistry), has resigned to accept a commercial position.

Oregon College.—Dean Ava B. Milam of the school of home economics has been granted a 2-year leave of absence for service in the University of Peking. A course in home economics is to be organized there and a building planned for this work, using Chinese architectural designs and American plans for heating, plumbing, and ventilation.

Porto Rico Insular Station.—A conference of the sugar chemists of the island was held at the station during the Eastern holidays to discuss problems affecting sugar manufacture, both from the factory and cultural point of view. The necessity for propagating the right varieties of cane in each locality was strongly emphasized. Two courses of instruction, lasting six weeks each, were given in October–November and January–February, respectively, by members of the station staff to the 35 newly appointed agricultural agents and an equal number of teachers.

E. D. Colón has resigned as director to become agronomist at one of the sugar centrals, Julius Mantz, chief of the division of botany and pathology, serving as acting director since March 1. F. López, chemist, has accepted a position as superintendent of fabrication at another sugar central and has been succeeded by M. Gorbea Plá. Dr. Alfonso Rivera has been appointed assistant veterinarian.

South Carolina Station.—The State legislature has appropriated \$50,000 for experimental work, about half to be expended at the college and the remainder at the substations and for cooperative experimental work on different soil types in the State.

The station has recently completed a steer feeding experiment using various concentrates with corn silage as a roughage. Velvet beans gave the most economical gains of the various concentrates used. The project will be repeated with some variation as soon as details are worked out. The entomology division of the station in cooperation with the extension service has purchased five two-horse dusting machines and will conduct cooperative dusting experiments against the boll weevil at the college farm and with farmers of the State.

W. D. Salmon has resigned as assistant animal husbandman to accept a similar position at the Alabama Station. C. B. Nickels has been transferred from field entomologist to research entomologist, vice H. S. McConnell, resigned.

Tennessee Station.—L. S. Mayer, assistant agronomist in the Bureau of Plant Industry, U. S. Department of Agriculture, has been assigned to the station to take charge of the department's corn experiments.

Virginia Station.—A. N. Hodgson, superintendent of the substation at Martinsville, resigned April 15 to become land appraiser for the Federal Farm Loan Board.

Washington College and Station.—Inquiry was recently made by the college of over 250 of its agricultural alumni who had been at work for some years as to the estimated financial advantage to them of their college education. Replies were received from 113 graduates, many of whom found themselves unable to give a definite estimate, but were certain of its positive value. Of the 36 graduates who attempted specific estimates, one set a figure of \$10,000 per year, and the others ranged between \$150 and \$3,000, with an average of \$1,453. This is the income of 7 per cent on over \$20,000. Only 7 graduates reported that their training had been of no value to them.

Answering a question as to what other ways their agricultural education had been of benefit, various merits were claimed. As expressed by one graduate, "it has given me a better understanding of men and citizenship, a more accurate judgment, and a higher ambition."

Investigations of cranberry diseases in the cranberry bogs of Pacific County have been commenced by the division of plant pathology. Through the cooperation of the county commissioners, the station, and the extension service, a trained pathologist will be placed in the county this season to conduct investigations of cranberry diseases and demonstrations in cranberry culture.

Seven purebred Holstein heifers sired by Segis Pontiac Acme, the senior herd sire, and bred to Pieb Hero, the junior herd sire, have been transferred to the Irrigation Substation at Prosser as a foundation for the purebred dairy herd at that station. This herd will be used in extensive pasture studies to be undertaken there and in experimental feeding work with dairy cattle.

Rothamsted Experimental Station.—The station has taken over the experimental field at Woburn used for many years by the Royal Agricultural Society, and will continue the tests of wheat and barley in connection with its work at Rothamsted. The society thus gives up its experimental farm, but is to continue its connection with scientific research through a research fund and committee to initiate or receive projects for investigation, and by carrying on experiments on the farms of its members. For the present four problems are to be studied, (1) the value of ground mineral phosphates, particularly in pasture improvements, (2) the use of various forms of lime on grass and tillage crops, (3) the use of wild white clover, bird's foot trefoil, etc., in laying down land to grass, and (4) the profitable utilization of whey. Arrangements are also being made for collating and publishing the accumulated findings of the society's work.

The library of the station has recently received from Lady Ludlow a gift of a copy of what is believed to be the first printed book on agriculture in France. This book is entitled *Le livre des prouffitz champestres et rurales*, and was printed at Lyon in 1539.

Institute of Agricultural Research in Palestine.—The Palestine Zionist Executive is opening an Institute of Agricultural Research in Jerusalem. This institute will be in charge of O. Warburg as head and botanist, with I. Wilkansky as director of experimental stations and farm management, F. Bodenheimer in charge of entomology, A. Treidal and M. Winik of chemistry, M. Wilkansky of agronomy, L. Pinner of plant breeding, N. Reichert of plant pathology, E. Pickholz of animal nutrition, and S. Zemach in charge of agricultural publications. Departments of horticulture, animal husbandry, irrigation, and agricultural education will be opened next year. The institute will for the present be under the direction of the Colonization Department of the Palestine Zionist Executive, but is expected to be transferred eventually to the Research Institute of the Jerusalem University.

Experimental stations in Ben-Shemen for the Shephela, Merhavia for the Jezreel Valley, and Degania for the Jordan Valley were established during the past year. It is anticipated that a similar station will shortly be opened in Beer-Sheba for the Nogob.

The institute is asking to receive publications of similar institutions elsewhere, its address being Tel-Aviv, Jaffa.

French Agricultural Commission to Nigeria.—A scientific commission has been appointed by the French Government to study the agricultural possibilities of French Nigeria, especially that portion lying between Bamoko and Timbuctoo. The construction of a huge dam in this vicinity is contemplated for the irrigation of the Upper Niger Valley. A general agricultural reconnaissance will be made by the commission, with special emphasis on cotton, covering a period of from 12 to 18 months. Dr. R. H. Forbes, formerly of the Arizona University and Station and who has just concluded his engagement with the Société Sultanienne d'Agriculture of Egypt, has accepted an appointment as agronomist on this commission and has entered upon his new duties.

Food Research Institute of Stanford University.—A prospectus recently issued by this institute, accounts of which have been previously noted (E. S. R., 44, pp. 399, 900), states that operations are expected to be fully under way by autumn. The precise program is to be developed gradually, its form being determined partly by the readiness with which essential data on specific subjects can be assembled and partly by the work already in progress elsewhere. The fundamental purpose will be to investigate significant food problems from the standpoint of their bearing upon national economy and well-being, dealing with them as mass problems and emphasizing the commodity and international aspects. The institute will concern itself with such subjects as the food elements in actual and normal standards of living, and the physiological and social aspects of subnutrition; the source, production, marketing, and utilization of important staple foodstuffs, such as wheat; the financing of farm operations and the manufacture and marketing of food products; the analysis of important food industries and the problems which they present; the technology of food manufacture and the desirable scope of public control thereof; and the elements in a sound national policy with respect to food production, international distribution, and international trade.

The policy of the institute is announced as to avoid so far as possible any serious overlapping of the work of established research organizations, public or private, and to seek to cooperate with such organizations wherever possible. Its own research will be carried on for the most part at Stanford University.

In general the subjects for investigation selected will be such as do not necessitate extensive field work or those in which the results of the field work conducted by other agencies can be utilized.

The institute has been organized as an integral part of the university, with the status of a department for the purpose of directing research and recommending degrees. For the year 1922-23, four fellowships for graduate study in food research have been established. Graduate instruction may also be offered to a few other students, and courses may be arranged for other departments of the university.

Dissemination of results is to be both through established journals and a series of publications to be issued by the institute itself.

Home Economics Instruction at Harvard University.—The Graduate School of Education of Harvard University is contemplating a course in the administration of home economics education in the current summer session if there are sufficient students to warrant it. This course will be designed to meet the needs of superintendents, principals, home economics supervisors and teachers, and all others who are interested in studying this important phase of woman's education. It will emphasize the origin and development of contemporary theories, problems, and practices in the teaching of home economics as influenced by the economic and social changes in the modern family organization. An examination will be made of each type of school, the elementary, junior high, high, part-time, vocational, and evening school, to discover the character and organization of the home economics work each should furnish. An effort will be made to measure present practices by appropriate criteria based on modern demands. Courses of study will be formulated and discussed, and such problems will be examined as the case and project method, job analysis, proficiency tests, and the relation of home economics studies to the academic subjects in the curriculum and to a well-rounded program of education.

A second course for home economics teachers may also be offered if the demand warrants. This course would cover detailed studies of special phases of home economics education, such as methods of teaching the division of family income, related art in the home economics program, job analyses of home management, and the teaching of child care and development.

New England Research Council.—Steps were taken at a recent meeting of the Boston Chamber of Commerce to organize a New England Research Council to study the food supply and marketing problems of the region. President K. L. Butterfield of the Massachusetts College was elected chairman of the groups of agricultural colleges and the Federal and State departments of agriculture and other agencies interested in the formation of the council.

Necrology.—Dr. W. B. Bottomley, professor of botany at King's College, University of London, from 1893 to 1921, died March 24, aged 58 years. Dr. Bottomley was widely known both as a lecturer and for his studies of problems of plant nutrition and their relation to agriculture. Some of his most important work dealt with the agricultural utilization of peat through the action of ammonifying and nitrifying organisms, and some years ago he announced the discovery in such materials of what he termed "auximones," growth-promoting substances somewhat analogous in plant nutrition to vitamins in animal development.

The death on February 3 was noted of Vladimir Ivanovitch Palladin, for many years professor of plant anatomy and physiology in the University of Petrograd. Prof. Palladin had made many contributions to botanical science, chiefly of a biochemical nature, and many dealing with the respiration of

plants, the decomposition of proteids in plants, and the formation of chlorophyll. An English edition of his text on plant physiology was issued in 1918.

Dr. A. D. Waller, director of the physiological laboratory of the University of London since 1902 and widely known for his studies on various physiological problems, died March 11, aged 67 years.

The death at Cairo on April 12, is reported of A. W. Bacot, head of the department of entomology of the Lister Institute.

New Journals.—*The Journal of Rural Education* is being published monthly throughout the school year by the Rural Department of the National Education Association.

Journal of the Department of Agriculture is being issued as the official organ of the Department of Agriculture of the Union of South Africa, replacing the *Agricultural Journal of the Union of South Africa*, which was suspended in August, 1914, because of financial conditions created by the war.

Bengal Agricultural Journal is being published quarterly by the Bengal Department of Agriculture, replacing the annual yearbook, and serving as a medium to connect the department with practical farmers.

The Department of Agriculture of Fiji is issuing *Agricultural Circular* monthly. It will include both technical and popular articles devoted to the agricultural and pastoral interests of the country.

Boletín de Agricultura, Industria, y Comercio de Guatemala is being published as the official organ of the Secretary of Agriculture of Guatemala.

Anales de la Asociacion Argentina Criadores de Shorthorn is being published monthly in the interests of Shorthorn cattle breeding in Argentina.

Agriculture, published at the College of Agriculture of the University of Nebraska, has been rechristened *The Cornhusker Countryman*.

Miscellaneous.—The entomological laboratory and offices of the Station Agronomique de la Guadeloupe were recently destroyed by fire. Among the material lost was the mailing list, and the station asks to be informed of individuals and institutions desiring to continue to receive its publications. Correspondence should be addressed to the Director, Station Agronomique, Pointe-à-Pitre, Guadeloupe, West Indies.

The University of Chicago is planning to open a department of agricultural commerce in its school of commerce and administration. It is expected as a part of this work to carry on studies of problems in agricultural commerce in cooperation with the research branches of large agricultural corporations.

The retirement this month is announced of Prof. Robert Wallace, who has occupied the chair of agriculture and rural economy in the University of Edinburgh for 37 years.

A sugar experiment station has been opened under Government auspices at Plantation Sophia on the east coast of British Guiana.

The Research Laboratories of the British Cotton Industries Association at Shirley Institute, Manchester, were formally opened by the Duke of York, March 28.

A. H. MacLennan has been appointed professor of horticulture in the Ontario Agricultural College, vice J. Warren Crow.

J. Griffith has been appointed head of the department of agricultural chemistry at the University College of North Wales.

EXPERIMENT STATION RECORD.

VOL. 46.

ABSTRACT NUMBER.

No. 9.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

The proteins of the alfalfa plant, T. B. OSBORNE, A. J. WAKEMAN, and C. S. LEAVENWORTH (*Jour. Biol. Chem.*, 49 (1921), No. 1, pp. 63-91).—This paper reports the results of an application to the alfalfa plant of the methods developed in the study of the proteins of the spinach leaf (*E. S. R.*, 43, p. 409).

The green alfalfa plants were thoroughly ground in a meat chopper and in a Nixtamal mill, and were then extracted successively with water, alcohol, dilute aqueous alkali, and dilute alkaline alcohol. The approximate proportions of ash-free solids and of nitrogen soluble in the different solvents were, respectively, as follows: Soluble in water 42.7 and 43.8 per cent, in 93 per cent alcohol 6.4 and 2 per cent, in 0.3 per cent aqueous NaOH 5.2 and 7 per cent, in 0.3 per cent alcoholic NaOH 17.8 and 39.3 per cent, and in extracted residue 29.1 and 5.3 per cent. The small proportion of nitrogen left in the residue is thought to indicate that the cells were ruptured so completely that nearly all of the nitrogenous substances were extracted by the various solvents.

Preliminary work on the various fractions showed that the undiluted juice of the plant contains about 10 per cent of solids, a part of which is in colloidal solution. On the addition of about 20 per cent alcohol, this separates out as a flocculent precipitate which can be readily filtered off, leaving a filtrate containing much nitrogen but less than 1 per cent of protein. Most of the latter appears to have the characteristics of proteoses. About 70 per cent of the flocculent precipitate consists of protein. There are also present in this precipitate calcium phosphate and calcium salts of organic substances which appear to be largely pigments resembling the flavone derivatives already known to occur in many species of plants. The protein of this colloidal precipitate was found to combine with hydrochloric acid without passing into solution at room temperature. When suspended in water this compound is converted into a jelly on heating. The protein behaves in a similar way with dilute alkalis but passes into the gelatinous state at room temperature.

The alcoholic extract contained nearly all of the chlorophyll, together with other substances, the nature of which has not been determined. A part of the nitrogen extracted by dilute sodium hydroxid proved to be a protein precipitable by slightly acidifying the extract. This precipitate also contained some pentosans. About 60 per cent of the nitrogen extracted by alcoholic alkali is of protein nature which can be precipitated by the cautious addition of acid.

The composition of Chinese edible birds' nests and the nature of their proteins, C. C. WANG (*Jour. Biol. Chem.*, 49 (1921), No. 2, pp. 429-439,

figs. 3).—An extensive study of the composition of Chinese edible birds' nests is reported in this and the following paper.

From the general properties the essential material of the birds' nests appears to be that of a glycoprotein. Its percentage composition agreed quite closely with that of salivary mucin, the average of three analyses being moisture 11.60, ash 2.51, phosphorus 0.035, sulphur 1.10, and total nitrogen in the original birds' nests 8.78, in the nests with feathers partly removed 9.15, and after hydrolysis with 20 per cent HCl 10.29 per cent. These differences are attributed chiefly to the variations in the amount of feathers present. In artificial digestion experiments, the birds' nest was digested by both pepsin hydrochloric acid and trypsin at a slower speed than boiled egg.

The average distribution of nitrogen in percentage of total nitrogen was as follows: Amid N 10.08 per cent, humin N 6.68, arginin N 13.95, cystin N 3.39, histidin N 6.22, lysin N 2.46, amino N of monamino acids 50.19, and nonamino N of monamino acids 7.22 per cent.

In feeding experiments with rats, the nest protein proved to be of inferior quality, as it failed to supplement a ration adequate in all respects except that the source of protein was derived from either the maize kernel or rolled oats.

The isolation and the nature of the amino sugar of Chinese edible birds' nests. C. C. WANG (*Jour. Biol. Chem.*, 49 (1921), No. 2, pp. 441-452).—After unsuccessful attempts to isolate the amino sugar from edible birds' nests by the methods of previous investigators, it was found possible to isolate a crystalline compound by hydrolysis of the material with dilute hydrochloric acid until the material had gone completely into solution but without forming a black precipitate, extracting the dried residue 15 or 20 times with alcohol, and evaporating the extract under diminished pressure to a thick sirup, treating the sirup with a large quantity of methyl alcohol, filtering, and treating the filtrate with about eight times its volume of absolute alcohol. By recrystallization three sets of crystals having the percentage composition of hexosamine were obtained. These are thought to be the α - and β -forms of the hexosamine and a mixture of the two.

A method for the separation of amino acids from the products of hydrolysis of proteins and other sources.—Preliminary communication, H. W. BUSTON and S. B. SCHRYVER (*Biochem. Jour.*, 15 (1921), No. 5, pp. 636-642).—The method described, which was first applied to the base-free extract of cabbage after the separation of most of the nitrogenous substances by the technique described by Chibnall and Schryver (*E. S. R.*, 44, p. 504) and was later tested on the hydrolysis products of caseinogen and gelatin, consists essentially in the preliminary removal of the tyrosin by evaporation to small bulk, the nitrogenous bases by precipitation with phosphotungstic acid, and the dicarboxylic acids by precipitation with barium hydroxid and alcohol, after which the amino acids are precipitated as the barium salts of their carboxylates by alternate treatment of the liquid with barium hydroxid and carbon dioxid in the presence of alcohol. By using equal volumes of the solution from which the amino acids are to be precipitated and of 95 per cent alcohol and adding barium hydroxid to saturation before treating the liquid with CO_2 , the best results are said to be obtained. The treatment has to be repeated about four times for complete precipitation. The precipitates, either singly or combined, can then be decomposed by boiling twice with three times their weight of water for 5 minutes, filtering, evaporating the filtrate to small bulk in vacuo, and crystallizing from absolute alcohol.

The effect of heat on the calcium salts and rennet coagulability of cow's milk. L. S. PALMER (*Soc. Expt. Biol. and Med. Proc.*, 19 (1921), No. 3, pp. 137-142).—In this contribution from the Minnesota Experiment Station, the literature on the explanation of the effect of heat on the calcium phosphate of milk

is reviewed and experimental evidence is presented in proof of the hypothesis advanced by the author that the calcium phosphate (CaHPO_4) of cow's milk is in colloidal solution and as such is precipitated by heat. That this loss of colloidal CaHPO_4 is, however, not responsible for retarding the coagulation of heated milk by rennet is indicated by the fact that the addition of colloidal CaHPO_4 to dialyzed milk does not restore its coagulation by rennet, while the addition of calcium chlorid or hydrochloric acid does restore this property. The author is inclined to the view that the effect of heat on rennet coagulation can be explained on the ground of an effect of heat on the casein itself. The calcium caseinate of milk, which is considered to be in colloidal solution, is apparently hydrolyzed by rennet into two molecules of calcium paracaseinate, the clotting of which is evidently disturbed by the application of heat.

The relation of acidity to the coagulation temperature of evaporated milk, L. A. ROGERS, E. F. DEYSHER, and F. R. EVANS (*Jour. Dairy Sci.*, 4 (1921), No. 4, pp. 294-309, figs. 3).—A study is reported from the Dairy Division, U. S. D. A., of the factors influencing the coagulation of evaporated milk prepared from mixed milk of a number of herds, and the results obtained are compared with those reported by Sommer and Hart in a somewhat similar study of the heat coagulation of fresh milk from individual cows (E. S. R., 42, p. 208). Some of the points brought out in this comparison have been previously noted from another source (E. S. R., 45, p. 111).

The particular points investigated were the relation of the acid-base ratio to the coagulation temperature of evaporated milk and the influence on the coagulating temperature of the H-ion concentration as changed by the addition of acid and by the growth of bacteria. The variation in the coagulating temperature of different samples of mixed-herd milk was found to be comparatively small and to have little relation to the coagulating temperature of the same milk after evaporation, thus making it impossible to predict the temperature at which the evaporated milk will coagulate. No direct relation was found to exist between excessive base over acid in the raw milk and the coagulating temperature of the evaporated milk. This is thought to be due partly to the rearrangement of the acid-base ratio during the condensing process, and partly to the obscuring effect of other factors.

Forewarming temperatures much below 95°C . (203°F .) had little effect on the coagulating temperature, while high forewarming, particularly if the heating was prolonged, tended to raise the coagulating temperature of the evaporated milk, evidently through the precipitation of part of the calcium.

No definite relation was found to exist between the coagulating temperature of the evaporated milk and its true acidity as measured by determinations of the H-ion concentration of the milk before sterilization. This is explained on the ground that the H-ion concentration giving the maximum stability to the casein varies with the composition of the milk. A small increase in the acidity from the normal of any particular sample will cause a distinct lowering of the coagulating temperature of the evaporated milk, although the final H-ion concentration may still be considerably under that of another sample which is comparatively stable. "The essential fact which must be established in this connection is not the mere H-ion concentration of the milk, but whether this has been changed from the normal of that particular milk."

The chemical composition of copra meal with special reference to the nature of its carbohydrates, E. M. CARAY (*Philippine Agr.*, 10 (1921), No. 2, pp. 55-68).—Copra meal (expeller product) was analyzed for its proximate composition and the nature of the carbohydrates present. The average percentage composition on the basis of the air-dry sample is given as follows: Moisture 11.19, ash 5.39, protein 20.94, oil 14.13, water-soluble free organic

acids calculated as oleic acid 7.07, crude fiber 13.82, carbohydrates 24.90, and undetermined 2.50 per cent.

The following carbohydrates were found to be present in the meal: Sucrose, raffinose, galactose, pentoses, fructose, glucose, cellulose, pentosans, starch, dextrin, and galactan.

The mannitol-producing organisms in silage, G. P. PLAISANCE and B. W. HAMMER (*Jour. Bact.*, 6 (1921), No. 5, pp. 431-443).—Experiments at the Iowa Experiment Station on the production of mannitol in silage fermentation (E. S. R., 37, p. 801) have been extended to the isolation from silage of organisms capable of producing mannitol when grown in pure cultures in corn, corn juice, and various other materials.

Mannitol-producing organisms were readily isolated from recently prepared silage and from fermenting corn juice. The use of oil to prevent mold growth in the cultures resulted in the production of larger amounts of mannitol than when oil was not used.

The organisms isolated proved capable of producing mannitol in the juice of cabbage and in silage made from corn, sunflowers, sugar cane, or dandelions, but not in the juice of carrots, beets, or apples. Fructose or materials giving fructose on hydrolysis also yielded mannitol when added to stover before sterilization. Glycerol, galactose, glucose, maltose, lactose, and starch did not yield mannitol under like conditions, while honey gave large amounts. The hydrolysis in the case of fructose or honey is thought to be due to the heating and the acid present and not to the action of the mannitol-forming organisms. The percentage of mannitol produced in different materials varied widely.

A number of materials were tested for mannitol-producing organisms. Soil from a farmyard and various samples of milk were found to contain such organisms.

Morphological, cultural, and biological studies of a number of organisms capable of producing mannitol showed that they can not be considered of one type. Most of them probably should be classed as *Bacillus manniticus*. One of the cultures proved to be *Bacterium casei*, and several were rod-shaped lactic-acid organisms.

The determination of H-ion concentration, F. H. McCrudden (*Pub. Health Rpts. [U. S.]*, 37 (1922), No. 7 pp. 334-348, figs. 3).—This paper, which was written especially for physicians and bacteriologists with a limited knowledge of chemistry, gives a concise explanation of the meaning of H-ion concentration, buffer mixtures, etc., and a description of the colorimetric method for the determination of H-ion concentration.

A buffered physiologic salt solution, A. C. EVANS (*Jour. Infect. Diseases*, 30 (1922), No. 1, pp. 95-98).—Attention is called to the influence of the H-ion concentration of the medium upon certain serological tests, and a method is described for the preparation of a buffered salt solution for the control of H-ion concentration in such tests. The technique is as follows:

An M/15 solution of primary potassium phosphate is prepared by adding 9.078 gm. KH_2PO_4 to 1 liter of distilled water, and a similar solution of secondary sodium phosphate is prepared by adding 11.876 gm. $\text{Na}_2\text{HPO}_4 \cdot 2\text{H}_2\text{O}$ to 1 liter of distilled water. These solutions may be mixed in the proportions given in Sorensen's tables to obtain any desired pH value between 5.3 and 8. For the preparation of the isotonic buffered salt solution 1 part of the phosphate mixture of the desired H-ion concentration is added to 9 parts of 0.9 per cent NaCl solution.

A buffer solution for colorimetric comparison, T. C. McILVAINE (*Jour. Biol. Chem.*, 49 (1921), No. 1, pp. 183-186, fig. 1).—The system developed by the

author requires but two stock solutions and is said to cover a range of from pH=2.2 to pH=8. The materials used are 0.2 M disodium phosphate and 0.1 M citric acid, combined in such volumes as to make 20 cc. of the mixture. The disodium phosphate employed was recrystallized three times and the standard solution prepared by titration against hydrochloric acid, using methyl orange as indicator. The citric acid was recrystallized at least twice before using. A table is given showing the proportions of the two solutions to use for stated pH values at intervals of 0.2 from 2.2 to 8.

A new microcolorimeter, V. C. MYERS (*Jour. Lab. and Clin. Med.*, 7 (1922), No. 4, pp. 237-239, fig. 1).—The apparatus described employs the principle of the wedge device used in the Kleiner apparatus (E. S. R., 44, p. 614), but uses instead for the standard a test tube in which is fused a solid wedge of colorless optical glass of such dimensions that the readings on a 100 mm. scale set in the instrument give the strength of the unknown in percentage of the strength of the standard.

The effect of the presence of filter paper on permanganate-oxalate titrations, S. G. SIMPSON (*Jour. Indus. and Engin. Chem.*, 13 (1921), No. 12, pp. 1152, 1154, figs. 2).—Data are reported on the extent of reduction of N/10 potassium permanganate solution by filter paper with varying time of contact, varying amounts of the permanganate, and in direct oxalate titrations under different conditions.

It was found that the reduction of the permanganate by filter paper increases rapidly with the first few drops of excess permanganate and in the first few moments of contact. Unless the filter paper is present in highly disintegrated form, satisfactory results may be obtained either by adding previously a small amount of manganous sulphate and titrating slowly, or by washing most of the oxalate from the paper with hot water and adding the paper only when the titration is nearly complete.

Methods for the determination of free and combined carbon dioxide, J. A. SHAW (*Jour. Indus. and Engin. Chem.*, 13 (1921), No. 12, pp. 1151, 1152, fig. 1).—The author has developed an apparatus for the determination of free and combined CO₂ in mine water which combines the principles of the Van Slyke apparatus (E. S. R., 37, p. 804) and the ordinary nitrometer. The apparatus is illustrated and the technique of its operation described in detail.

The determination of sulphurous acid, V. COPPETTI (*Ann. Falsif.*, 14 (1921), No. 155-156, pp. 336-339, fig. 1).—An ingenious trap to prevent the loss of iodine in the Haas method of determining sulphurous acid by distillation in a stream of carbon dioxide is described and illustrated. This trap, which surrounds the delivery tube through which the SO₂ passes into the receiving flask, is filled with N/10 sodium hyposulphite. Any vapors of iodine rising in the receiving flask as the gases enter are absorbed by the sodium hyposulphite in the trap. After the reaction is complete a stopcock connecting the trap with the receiving flask is opened, and the combined liquids are then titrated as usual.

The use of silica crucibles for the determination of potassium in soils, J. S. JONES and J. C. REEDER (*Soil Sci.*, 12 (1921), No. 5, pp. 419-432, figs. 3).—An investigation is reported from the Oregon Experiment Station of the accuracy attainable in the determination of potassium in soil by the substitution of electric furnace heat and crucibles of silica for gas and the platinum or nickel crucibles of the J. Lawrence Smith type in the fusion. It was found that an electric muffle furnace and silica crucibles of the ordinary shapes used for ignitions could be used for the fusions with satisfactory results within temperature limits of 812 and 855° C. Practically the same results were obtained by fusion at the lower temperature for approximately 90 minutes and

by prompt removal of the crucibles from the muffle when the temperature reached 855°, the first being the safer and the second the quicker procedure. The number of fusions that can be made simultaneously is limited only by the size of the muffle.

Experiments are also reported with the use of silica crucibles of the J. Lawrence Smith type. Unsatisfactory results were obtained when these crucibles were heated with gas, but when heated in an electric furnace of special design, which is described and illustrated, the determinations were as satisfactory as those made from fusions in platinum crucibles of the same type. This combination of crucible and furnace does not require the careful regulation of temperature necessary in the above technique.

The colorimetric determination of soil in a colored water extract, P. EMERSON (*Soil Sci.*, 12 (1921), No. 5, pp. 413-417).—A search for a satisfactory decolorizing agent to use in the phenoldisulphonic acid method with water extracts of soil possessing a high color due to actively decomposing organic matter has led to the recommendation of aluminum hydroxid for this purpose. This is prepared by dissolving 125 gm. of potassium or ammonium alum in 1 liter of water, adding cautiously sufficient ammonium hydroxid to turn red litmus blue, and washing by decantation until free of ammonia. The technique of the procedure is as follows:

Five gm. of precipitated calcium carbonate and 400 cc. of distilled water are added to 100 gm. of air-dry soil in 1-liter bottles. The mixture is shaken 15 minutes, allowed to settle 30 minutes, and an aliquot quickly drawn off by means of a 100-cc. pipette connected to a suction pump. The proper amount of aluminum hydroxid is added to the aliquot, which is then filtered through a coarse grade of paper and thoroughly washed. The amount of aluminum hydroxid necessary to decolorize the solution is determined by comparison with a standard 1 per cent caramel solution, varying amounts of which have previously been decolorized with aluminum hydroxid. The caramel solution of this strength has been found to give a color concentration similar to that of soil decolorized by equivalent amounts of aluminum hydroxid.

The quantitative estimation of the fat-soluble factor, S. S. ZILVA and M. MIURA (*Biochem. Jour.*, 15 (1921), No. 5, pp. 654-659, figs. 3).—For the quantitative estimation of vitamin A in food materials, the authors employ the following method:

Rats weighing from 50 to 60 gm. are placed on a basal vitamin A-free diet and are kept under observation for 3 or 4 weeks. It is stated that only from 10 to 15 days are generally required, but that some animals continue to grow beyond this time. In the subsequent tests only animals which do not weigh more than 70 gm. at the end of the preliminary period of 3 or 4 weeks are used. The substance to be tested for vitamin A is always administered in known quantities separately from the basal diet. In the case of oils, the oil is delivered in drops of known weight from a pipette into small pellets of the basal diet which are then covered with a little more of the powdered diet. Solid fats are previously melted at a low temperature and drops of the fat are allowed to solidify. The pellets or a known number of the drops of solidified fat are fed with a spatula before the animals receive the basal diet.

As a standard of comparison, the least dose which induces definite growth after the animals have ceased to grow on the basal diet is considered more reliable than the minimum dose required to produce normal growth. As tested in this way, the minimum dose of cod liver oil was found to vary from 1.75 to 5 mg., while the minimum dose of butter was from 200 to 400 mg. It is suggested that the superiority of cod liver oil over butter in the treatment of rickets may be due to the much higher content of vitamin A in the former.

The detection of foreign starches in flour, K. AMBERGER (*Ztschr. Untersuch. Nahr. u. Genussmit.*, 42 (1921), No. 7-8, pp. 181, 182).—The test depends upon the principle that at a temperature not exceeding 60° C. wheat, rye, barley, and oat starches are hydrolyzed by diastase, while corn, potato, and bean starches are unchanged and when separated from the soluble matter by centrifugation can be detected under the microscope.

Cider preservatives, R. D. SCOTT and E. G. WILL (*Jour. Indus. and Engin. Chem.*, 13 (1921), No. 12, pp. 1141-1143).—A study is reported of the efficacy of various preservatives to prevent fermentation of fresh commercial cider and for court work to hold the alcoholic percentage of seized samples of cider unchanged until analysis.

For the purpose of preserving samples for analysis thymol, salicylic acid, and probably mercuric chlorid are effective. The latter is not recommended on account of its poisonous nature, and thymol has the slight objection that it requires a second distillation with an excess of alkali. Salicylic acid (0.2 per cent) is considered the most satisfactory preservative for samples to be used in court work.

For preserving cider commercially, sodium benzoate and salicylic acid are considered of some value, the former in a concentration of 0.05 per cent and the latter of 0.1 per cent.

A new qualitative test for sucrose in the presence of glucose, L. A. CONGDON and C. R. STEWART (*Jour. Indus. and Engin. Chem.*, 13 (1921), No. 12, pp. 1143, 1144).—The test described depends upon the solubility of glucose and the insolubility of sucrose in ethyl acetate. If the mixture of sugars is dry, extraction with ethyl acetate for about 5 hours in an ordinary Soxhlet extractor results in the practically complete separation of the two sugars.

Determination of lactose in the presence of other reducing sugars.—**Supplementary note**, L. LE GRAND (*Ann. Falsif.*, 14 (1921), No. 153-154, pp. 268, 269).—The author has found 0.1 per cent to be the maximum concentration of alkaline or alkaline-earth salts which may be present in milk without forming a basic precipitate in the method of determining lactose in the presence of other reducing sugars by the use of Barfoed's reagent (*E. S. R.*, 46, p. 311).

Sugar calculations, J. F. LIVERSEGE (*Analyst*, 46 (1921), No. 548, pp. 446-451; *abs. in Chem. Abs.*, 16 (1922), No. 3, pp. 506, 507).—Various formulas are given by means of which the analysis of mixtures containing several sugars is said to be simplified.

Seed sugar beet selection by means of the refractometer, K. KOMERS (*Bl. Zuckerrübenbau*, 28 (1921), Nos. 17-18, pp. 177-183, figs. 2; 19-20, pp. 194-200; 21-22, pp. 220-225).—The author suggests the use of the refractometer as a means of judging the value of sugar beets for seed purposes. The beets are pressed and the usual refractometer determinations made on the extracted juice. A comparison of these readings will show the relative sugar strength of different samples.

Methods of blood analysis.—**III, The value of ultrafiltration methods in blood analysis**, M. RICHTER-QUITTNER (*Biochem. Ztschr.*, 124 (1921), No. 1-6, pp. 106-113).—Continuing the series of studies previously noted (*E. S. R.*, 43, p. 205), comparative results are reported on the determination of residual nitrogen, uric acid, chlorin, sodium, potassium, and sugar in blood following deproteinization with trichloroacetic acid and the use of the ultrafilter or membrane filter of Zsidmondy and Jander (*E. S. R.*, 42, p. 411). In all cases except the sugar determination the ultrafiltration method proved as satisfactory as the longer deproteinization method. It is considered to have the advantage of being much more rapid and capable of wider application.

The recovery of amyl alcohol from reaction mixtures, F. BENGEL (*Ztschr. Untersuch. Nahr. u. Genussmit.*, 42 (1921), No. 7-8, pp. 184, 185).—Directions are given for recovering amyl alcohol after the Gerber milk fat determination and the Halphen reaction for cottonseed oil.

In the former case 1 liter of the reaction liquid is diluted with 300 cc. of water in a 2-liter flask and distilled with steam until 50 cc. of the distillate is collected. The distillation is repeated with fresh portions until a considerable amount of the distillate rich in amyl alcohol is obtained. This is saturated with common salt and treated with sodium hydroxid until the red color produced by phenolphthalein persists after shaking. The amyl alcohol is separated from the salt solution in a separatory funnel, filtered through a dry paper, allowed to stand for some time over dry salt or fused sodium sulphate, and then fractionally distilled. The fraction coming over between 128 and 132° C. is suitable for the Gerber test. It is stated that from 6 liters of the original mixture 250 cc. of pure amyl alcohol can be recovered.

In recovering the amyl alcohol from the Halphen test 500 cc. at a time is distilled with steam in a liter flask, the distillate is thoroughly shaken, separated in a separatory funnel, and fractionally distilled at such a rate that one drop comes over in 2 seconds. The fraction distilling between 128 and 132° consists of pure amyl alcohol.

Industrial alcohol from cassava, M. L. ROXAS and R. V. MANIO (*Philippine Agr.*, 10 (1921), No. 2, pp. 75-84).—A study is reported of possibilities in the fermentation of cassava starch for the manufacture of industrial alcohol. A general method suggested is the hydrolysis of the flour with dilute sulphuric acid under pressure at 120° C. for 2½ hours, neutralization of the hydrolysate with ammonium hydroxid, and subsequent fermentation with yeast prepared by the Molhant process, as suggested by Brill and Thurlow (*E. S. R.*, 38, p. 508). A comparison of the cost of cassava flour and molasses as raw material for alcohol manufacture on the basis of cost of raw materials in the Philippines shows that cassava would be more expensive than molasses for alcohol production.

Preparation of pork on the farm, C. C. MORRIS and E. H. HOSTETLER (*N. C. Agr. Col. Ext. Circ.* 119 (1921), pp. 10, figs. 6).—This circular gives brief directions for the home curing and canning of pork.

Proposed modification of the sulphite process, V. P. EDWARDES ([*Tech. Assoc. Pulp and Paper Indus.*], *Tech. Assoc. Papers, Ser. IV, No. 1* (1921), pp. 22-29, figs. 5).—An investigation of possible methods of shortening the cooking time in the sulphite pulping process is reported from the U. S. D. A. Forest Products Laboratory, Madison, Wis.

Preliminary impregnation of the wood with the acid by exerting high pressure until the wood has absorbed all of the acid it can hold has been found to shorten materially the time required for the pulping and to allow of lower temperatures. It is noted, however, that in using the modified method of pulping, it is necessary to increase the amount of lime in the sulphite acid to take care of the increased speed of the chemical reaction.

METEOROLOGY.

Climatological data for the United States by sections (*U. S. Dept. Agr., Weather Bur. Climat. Data*, 8 (1921), Nos. 11, pp. [185], pls. 3, fig. 1; 12, pp. [191], pls. 3, fig. 1).—These numbers contain brief summaries and detailed tabular statements of climatological data for each State for November and December, 1921, respectively.

Meteorological summaries (*Kentucky Sta. Rpt. 1920, pt. 1, pp. 46-49*).—These are the usual summaries of observations on temperature, precipitation, wind, sunshine, and cloudiness during 1920, compiled from records of the U. S. D. A. Weather Bureau station at Lexington, Ky.

Meteorological observations at the Massachusetts Agricultural Experiment Station, J. E. OSTRANDER and G. E. LINDSKOG (*Massachusetts Sta. Met. Buls. 397-398 (1922), pp. 4 each*).—Summaries of observations at Amherst, Mass., on pressure, temperature, humidity, precipitation, wind, sunshine, cloudiness, and casual phenomena during January and February, 1922, are presented. The data are briefly discussed in general notes on the weather of each month.

SOILS—FERTILIZERS.

Soil conditions and plant growth, E. J. RUSSELL (*London and New York: Longmans, Green & Co., 1921, 4. ed., pp. XII+406, pls. 5, figs. 30*).—This is the fourth edition of this work (E. S. R., 39, p. 512). This action marks the removal of this book from the biochemical series and the inauguration of a new series to be called the Rothamsted Monographs on Agricultural Science, of which this is the first. In addition to introductory and historical statements it contains chapters on soil conditions affecting plant growth, the composition of soil the colloidal properties of soil, the carbon and nitrogen cycles in the soil, the biological conditions in the soil, the microorganic population of the soil and its relation to the growth of plants, the soil in relation to plant growth, and soil analysis and its interpretation. In addition appendices are included on methods of soil analysis, amounts of various substances absorbed from the soil by the common agricultural crops of England, and a selected bibliography of papers on soil conditions and plant growth.

The importance of physical chemical studies of soils, D. J. HISSINK (*Chem. Weekbl., 18 (1921), No. 32, pp. 447-450*).—The author summarizes his views relating to adsorption phenomena, soil acids, and chemical saturation of soils. The degree of adsorption of soils in bases is expressed by the

formula $V = \frac{S}{T} \times 100$, in which V is the degree of adsorption, S is the amount of adsorptively combined bases, and T is the total amount of bases in the soil.

It was found in studies that the degree of base saturation of soils containing so-called clay acids has little influence on the hydrogen-ion concentration of the soil solution. On the other hand, it is pointed out that the saturation of soils containing so-called humus acids can markedly influence hydrogen-ion concentration. When the saturation is low, apparently the pH value of the soil solution is also low. A study of acid, neutral, and alkaline sand soils containing considerable humus showed a definite relation between the lime content of the humus, the degree of saturation in bases, and the hydrogen-ion concentration.

The origin of soil colloids and the reason for the existence of this state of matters, M. WHITNEY (*Science, n. ser., 54 (1921), No. 1409, pp. 653-656*).—In this contribution from the Bureau of Soils, U. S. D. A., a highly technical discussion of the subject is presented.

It is the author's present view that "particles of matter derived from silicate rocks and other soil-forming minerals when they approach a diameter of 0.0001 mm. contain relatively so few molecules that the bombardment of the water molecules in which the particle is immersed shatters the particle beyond the ability of the molecules in the solid to hold together as a solid mass. The atoms of calcium, magnesium, potassium, and sodium in the molecule of the silicate would go for the most part into true solution, while the atoms of silicon, alu-

minum, and iron would go chiefly into colloidal solution forming the basis of the colloidal matter or the ultra clay of the soil."

Adsorption by soil colloids, N. E. GORDON, R. C. WILEY, E. B. STARKY, A. L. FLENNER, and D. C. LICHTENWALNER (*Science, n. ser.*, 54 (1921), No. 1406, pp. 581, 582).—In a contribution from the University of Maryland, the preliminary results of studies on the adsorption of different salts by the gels of silica, iron, and aluminum are presented in tabular form. No conclusions are drawn.

The importance of the formation of layers in clay and soil suspensions for mechanical analysis, E. UNGERER (*Fühling's Landw. Ztg.*, 69 (1920), No. 21-22, pp. 409-415).—Studies are reported, the results of which are taken to indicate that since size and weight of particles are the factors governing the formation of layers in suspensions, a simple means of reckoning the size of particles in fine suspensions is offered by the formation of such layers.

Studies to explain the formation of layers in clay suspensions and its use in soil analysis [for determining particle sizes], E. UNGERER (*Kolloid-chem. Beihefte*, 14 (1921), No. 3-5, pp. 63-96).—Studies conducted at the University of Göttingen are reported which showed that the size and weight of the individual particles are factors governing the formation of layers or strata in clay suspensions, and that each layer consists either wholly of particles of the same size or of groups of particles of the same size.

Under the latter condition the individual layers showed marked variations in weight and size of particles. The turbidity between two layer surfaces was of uniform concentration. Constant and uniform temperature was favorable to the proper formation of layers. Layers were formed in suspensions containing electrolytes as well as in plain suspensions, although an increased content of electrolytes having a coagulating action inhibited their formation. Individual layers rose or fell at a uniform speed. From the data on speed of rise or fall the size of particles can be computed by Stokes law for each group of particles.

Hygroscopicity of soil, C. T. MENDES (*Escola Agr. "Luiz de Queiroz," Piracicaba, Brazil, Bol.* 6 (1920), pp. 20, pls. 4).—A series of studies with red soil, natural field soil, washed sand, and different artificially prepared soils is reported.

It was found that hygroscopicity in soil increases with time but not proportionally thereto, irregularities being attributed to temperature variations. Soils containing a high percentage of fine clay particles, such as the red soil, fixed more hygroscopic water than other soils. Hygroscopicity increased as the pressure of stratification increased, but not proportionally. It was directly proportional to the amount of exposed surface area of the soil and decreased as the depth of stratum increased. Hygroscopicity was found to increase in poor soils as the contents of organic matter, kaolin, and of such colloids as aluminum and ferric hydrates increased, but not proportionally.

It is concluded that the principal factor influencing hygroscopicity of soil is the surface area exposed directly or indirectly to the atmosphere.

The classification of soil moisture, F. W. PARKER (*Soil Sci.*, 13 (1922), No. 1, pp. 43-54, figs. 4).—In a contribution from the University of Wisconsin, studies are reported the results of which are taken to indicate that the soil does not render water inactive as a solvent and the water therefore does not become unfree, as was found by Bouyoucos in previous studies (*E. S. R.*, 45, p. 20). It is further concluded that the dilatometer method does not measure different forms of water in the soil, and that soils do not contain a considerable percentage of water which does not act as a solvent. Evidence in support of these conclusions is summarized in some detail.

The measurement of soil drainage, with an account of the Craibstone drain gauges, J. HENDRICK (*Highland and Agr. Soc. Scot. Trans.*, 5. ser., 33 (1921), pp. 56-79, figs. 6).—A brief discussion of lysimeter studies in Great Britain is followed by a description of the relatively recent lysimeter installations at the Craibstone farm of the University of Aberdeen in Scotland. In addition, the records obtained during 1919 and 1920 with this apparatus are summarized and compared with the results of similar studies at the Rothamsted Experimental Station.

The Craibstone gauges are three in number, each being 0.001 acre in area. Each gauge contains soil 40 in. in depth. The soil is of glacial origin, tends to be acid in reaction, and contains no calcium carbonate. It was found during 1919 and 1920 that the rate of drainage from the three lysimeters was not uniform, which is attributed to inequalities in the consolidation and character of the soils. It was noted that in January and February the drainage either equaled or exceeded the rainfall. During the warmest months, even when there was considerable rainfall, the whole of the rainfall was reevaporated from the surface of the soil or transpired by the crop grown upon it, and practically nothing escaped in the drainage.

The chemical composition of the drainage water was quite different from that at Rothamsted, especially in the case of the bases. The loss of lime was small from this soil, but the losses of soda, potash, and magnesia were large. The loss of potash is taken to indicate a large available supply in the soil. The chief acids lost in drainage were silicic, sulphuric, hydrochloric, and nitric acids. Practically the whole of the combined nitrogen which escaped in the drainage was in the form of nitrate. Nothing more than traces of phosphate was ever found in the drainage water.

The movement of saturated water vapor through quartz flour, S. EWING (*Soil Sci.*, 13 (1922), No. 1, pp. 57-61 figs. 2).—In a contribution from the Utah Experiment Station, theoretical and actual studies are reported in an attempt to use the well-known principles of mechanics to solve the problem of water vapor movement through soils. Beginning with several assumptions an equation is developed which expresses the relation between the rate of absorption and the depth of the soil. The results show that qualitatively the theory is in accord with the facts.

Soil reaction, E. A. FISHER (*Sci. Prog.* [London], 16 (1922), No. 63, pp. 408-425, figs. 3).—In a contribution from the Leeds University, a general discussion of the nature of soil fertility and the importance of soil reaction as a factor in soil fertility is presented. The different theories of soil acidity are reviewed and methods of determining soil acidity enumerated. Special attention is drawn to the relation between soil acidity and physico-chemical conceptions of acidity, including hydrogen-ion concentration.

Soil sourness—its meaning and significance, F. HARDY (*West Indian Bul.*, 19 (1921), No. 1, pp. 37-85).—This is a compilation of what are considered to be the main facts connected with the modern conception of soil sourness. True soil acidity and deficiency in calcium compounds are first discussed as factors in soil sourness. Other factors dealt with are the toxicity of aluminum, iron, and manganese and the absence of adequate aeration.

The nature of soil acidity in northeast India, P. H. CARPENTER and C. R. HARLER (*Indian Tea Assoc., Sci. Dept. Quart. Jour.*, 1921, No. 3, pp. 121-144).—Investigations into the specific nature of the soil acidity which occurs under conditions prevailing in soils of the northeast India tea districts and of means of removing or inhibiting the action of such acidity are reported.

The conclusion is drawn that soil acidity in the district is due chiefly to the presence of soluble ionic salts of aluminum, the amount of which is largely

influenced by the quantity of aluminum hydroxid present in the soil. The studies showed that the acidity of these soils can best be determined by a method which estimates the amount of alumina capable of easily entering the soil solution. The Hopkins method is suggested in this connection. The lime requirement methods at present employed were found to be unsatisfactory for giving a true representation of the soil acidity.

Acidity due to aluminum was found to be overcome by potash, which removed it from the soil, or by lime and superphosphate, both of which fixed it in the soil. The degree of chemical hydration of the soil colloids, some of which are aluminum bodies, affected soil acidity. In this manner rainfall, cultivation, and drainage exerted an influence.

It is concluded that potential acidity is largely measured by the amount of the easily soluble alumina, and that acidity is a factor of an inverse order to soil fertility. It is also concluded that the type of acidity connected with aluminum hydroxid prevails in the Tropics or where laterization of silicious aluminum minerals is taking place.

A bibliography is included.

The relation of hydrogen-ion concentration in soils to their "lime requirement," H. W. JOHNSON (*Soil Sci.*, 13 (1922), No. 1, pp. 7-22, figs. 9).—Studies conducted at the Iowa Experiment Station with samples of 50 soils of widely varying types are reported.

As a whole no relation was found between the lime requirement as determined by the Veitch method and the hydrogen-ion concentration as measured by the hydrogen electrode. The Truog method of measuring the lime requirement gave results which were a combination of the Veitch lime requirement and the hydrogen-ion concentration. In soils of similar type there was a relation between the apparent quantity of acids and the strength of the acids. Soil acidity in mineral soils is considered to be apparently due to weathering and leaching rather than to the accumulation of organic acids. Clay particles and organic matter are thought to act as buffers to keep down the hydrogen-ion concentration.

Ferrous sulphate treatment of soil as influencing the soil solution obtained by the Lipman pressure method, C. B. LIPMAN (*Soil Sci.*, 13 (1922), No. 1, pp. 55, 56).—In a contribution from the California Experiment Station, studies are briefly reported the results of which indicate the effectiveness of ferrous sulphate as a modifier of the composition of the soil solution. When added to orchard soils, which were afterward sampled and subjected to the Lipman pressure method, it appeared to increase markedly the content of nonvolatile solids in the soil solution and to precipitate the dissolved organic matter therein. It is thought that the iron substitutes itself readily for the common bases calcium and potassium, and it seems for some reason to bring more phosphorus into solution.

Ammonia, nitrate, and carbon dioxide formation in relation to the best mechanical soil condition, P. H. CARPENTER and A. K. BOSE (*Indian Tea Assoc., Sci. Dept. Quart. Jour.*, 1921, No. 3, pp. 103-120 pls. 7).—Studies to determine at what soil moisture percentage ammonia formation and nitrate accumulation are most rapid and whether the soil optimum water content for these is related to that for the best mechanical condition in tea soils are reported. An endeavor was also made to correlate such factors with carbon dioxide formation. The tea soil used was a silty sand of sedimentary origin, deficient in organic matter, lime, phosphoric acid, and nitrogen, and of acid reaction.

It was found that both high and low soil moisture contents affect the formation of ammonia in this soil to a very considerable degree. This was particularly noticeable with high water contents when the amount of ammonia formed

was reduced. While the formation of ammonia was restricted at a low moisture content, the restriction of the activity of the micro-organisms causing ammonia formation was not so marked as that of the organisms bringing about nitrate formation, and the result was an accumulation of ammonia in the soil. When the moisture content of the soil approximated the mechanical optimum water content, the ammonia formed was rapidly converted into nitrates and only small quantities were found. This is taken to indicate that under such conditions the activity of the micro-organisms forming ammonia is the controlling factor in nitrate formation. It is concluded that the water content of the soil found to be most suitable for nitrate formation, if it lies between the high and low moisture content as found to control ammonia formation, must be the optimum water content also for ammonia formation, and perhaps is a truer indication of the optimum water for ammonia formation than for nitrification.

In studies of nitrate accumulation when both oil cake and calcium carbonate were added to the soil, it was found that in no instance were nitrates formed in more than small amounts. It was noted that at the highest moisture content the nitrates were diminished in amount as the time increased or else were practically absent. There was very little definite indication of an optimum water content for nitrate accumulation, except that it lies above 11 and below 21 per cent. When oil cake was used a definite optimum water content was obtained, which for this soil was approximately 14 per cent. In the very wet samples nitrification was inhibited or denitrification proceeded as fast as the nitrates were formed. It is concluded that the optimum water content for the nitrifying bacteria can vary within wide limits, the upper limit of which has not been determined and the lower limit being approximately 14 per cent.

In the carbon dioxide studies it was found that at a certain water content, which is defined within fairly narrow limits, there is an optimum water content for carbon dioxide formation. The various samples of soil alone or mixed with oil cake showed about the same optimum water content, which is approximately 14 per cent and which is the same optimum water content for nitrate accumulation and the best mechanical condition of the soil. A correlation between these factors and the same optimum water content therefore exists.

In similar studies of another type of soil it was found that the optimum water content for rapidity of ammonia formation, nitrate accumulation, and carbon dioxide production was approximately 20 per cent, which is practically the same as the optimum for the best mechanical conditions.

Transformation of organic matter in the soil, G. ROSTER (*Atti R. Accad. Georg. [Florence]*, 5. ser., 18 (1921), No. 2, pp. 47-63).—A summary is given of information and opinions from different sources on the biological and chemical processes involved in the decomposition and transformation of organic matter in soil.

Toxic action of dead leaves on germination, A. LUMIÈRE (*Compt. Rend. Acad. Sci. [Paris]*, 172 (1921), No. 4, pp. 232-234).—Studies are reported in which it was found that maceration of dead leaves in rain water immediately after their fall produced a liquid which is neutral in reaction, has reducing properties, and includes phenols. This liquid completely prevented the germination of grain. After removing the first solution, a second and less concentrated solution was obtained with rain water, which had the same inhibiting influence on the germination of grain.

Organic debris submitted to natural processes of decomposition as they occur in soil showed that the first modification was effected by microorganisms,

the most important of which is a bacillus of the coli species. After three months' fermentation a reddish-brown liquid was extracted which was difficult to filter and absorbed oxygen from the air. It had marked reducing properties and inhibited the germination of grain.

These results led to the conclusion that the action of these materials on germination is due to the fact that the solutions formed of certain of their constituents by rain water absorb oxygen from the soil at such a rate as to deprive plants of the amounts necessary in germination.

Presence of arsenic as a normal element in vegetable soils, F. REICHERT and R. A. TRELLES (*An. Asoc. Quim. Argentina*, 9 (1921), No. 42, pp. 89-95).—Analyses of samples of 20 soils from different parts of Argentina are reported and discussed. All of these soils but one were found to contain arsenic, the amounts varying from 0.1 to 2.25 mg. per 100 gm. of soil. No relation was established between the arsenic content and the chemical composition of these soils. The surface soils contained the most arsenic, and the content diminished with the depth.

Automatic registering method for mechanical soil analysis, S. ODÉN (*Bul. Geol. Inst. Univ. Upsala*, 16 (1918-19), pp. 15-64, pl. 1, figs. 18; *abs. in Chem. Abs.*, 15 (1921), No. 10, pp. 1590, 1591).—In a contribution from the University of Upsala, Sweden, the theory of the method and apparatus noted below is presented.

An automatic registering apparatus for mechanical soil analyses and experiments therewith, S. ODÉN (*Internatl. Mitt. Bodenk.*, 9 (1920), No. 5-6, pp. 301-342, pls. 10, figs. 11).—The author describes in some detail an apparatus developed at the University of Upsala, Sweden, for the automatic measurement and registration of the rate and amount of accumulation of particles of different sizes in the process of mechanical analysis of soils by sedimentation. It is thought that the main advantage of this apparatus over others lies partly in the elimination of disturbing influences, and partly in that it permits measurement and registration of the amount and distribution of particles as small as 0.1 μ during longer periods of time with a minimum of trouble and tedium.

A number of experiments with Swedish soils and clays are briefly described to indicate the manner of operation and effectiveness of the apparatus.

Preliminary treatment of soil samples for mechanical analysis, S. ODÉN (*Bul. Geol. Inst. Univ. Upsala*, 16 (1918-19), pp. 125-134, pls. 3, fig. 1).—Studies with clay soils containing practically no humus are reported in which different methods of preliminary treatment of soil samples for mechanical analysis were tested.

The so-called normal method was found to be the best for this purpose. In this method the sample is brushed with a stiff brush when in distilled water, after which the larger particles are removed by sedimentation or by a centrifuge, and the material is brushed again. Enough ammonia is added to give a 0.01 normal solution, and the whole is machine mixed for 24 hours. The ammonia is effective in breaking up the coarser aggregates, especially in soils containing calcium salts and in clay soils containing sodium, potassium, and magnesium chlorids. Grinding in a mortar and boiling were found to be inadvisable.

Soil survey of Mahaska County, Iowa, E. C. HALL and J. A. ELWELL (*U. S. Dept. Agr., Adv. Sheets, Field Oper. Bur. Soils*, 1919, pp. 40, fig. 1, map 1).—This survey, made in cooperation with the Iowa Experiment Station, deals with the soils of an area of 363,520 acres in southeastern Iowa. The surface of the area is that of a rolling plain. The natural drainage system of the county is said to be well developed. The soils are of glacial and loessial origin. Including riverwash, 23 soil types of 17 series are mapped, of which

the Clinton, Tama, and Grundy silt loams cover 33.4, 22.4, and 20.3 per cent of the area, respectively.

Soil survey of Sabine Parish, La., E. H. SMIES ET AL. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1919, pp. 62, pls. 2, fig. 1, map 1*).—This survey, made in cooperation with the Louisiana Experiment Stations, deals with the soils of an area of 641,280 acres lying within the Coastal Plain on the western boundary of Louisiana. The topography is for the most part gently rolling to rolling. Most of the upland is said to have adequate surface drainage.

The soils are of sedimentary and alluvial origin, and include uplands, first bottoms, and second bottoms. Twenty-seven soil types of 16 series are mapped, of which the Susquehanna very fine sandy loam covers 41.4 per cent of the area.

Soil survey of Moore County, N. C., R. C. JURNERY ET AL. (*U. S. Dept. Agr., Adv. Sheets, Field Oper. Bur. Soils, 1919, pp. 44, fig. 1, map 1*).—This survey, made in cooperation with the North Carolina Department of Agriculture, deals with the soils of an area of 412,160 acres lying within both the Piedmont Plateau and Coastal Plain provinces in south-central North Carolina. The topography ranges from level to rolling and steep. With the exception of areas of swamp and some of the first bottoms, the county is said to be well drained.

The soils are prevailingly light in color, ranging from light gray or yellowish gray to red, and are said to be dominantly low in organic matter. A noticeable and general characteristic of these soils is the absence of free carbonates and generally acid character. Light sandy soils prevail in the southern half of the county and the heavier soils in the northern part. Including swamp, 23 soil types of 13 series are mapped, of which the Norfolk sand and Hoffman sandy loam cover 28.3 and 19.1 per cent of the area, respectively.

Studies in West Indian soils.—I. The soils of Dominica, their genesis and fertility considered in relation to reaction, F. HARDY (*West Indian Bul., 19 (1921), No. 1, pp. 86–123, pl. 1*).—These studies indicate that the soils of the island of Dominica have been derived from volcanic rocks which so far as is known consist chiefly of hypersthene andesite and its fragmental equivalents. Grains of minerals such as plagioclase feldspars and ferromagnesium have been identified in these soils. The soils are grouped in accordance with variations in rainfall and differences in topography into three groups, namely, soils of the central uplands, soils of the windward coastal belt, and soils of the leeward coastal belt.

Chemical studies of these soils showed that laterization, due mainly to excessive leaching, has apparently gone on to a considerable extent in the wetter districts of Dominica. The central uplands soils are markedly acid in reaction, while the leeward soils are approximately neutral. The windward soils are somewhat intermediate in type. The cultivated soils of the leeward coastal belt are said to be highly fertile for the growth of cacao and limes. The upland soils support a luxurious forest vegetation, which is taken to indicate an apparent high degree of fertility.

Soils, L. A. HENKE (*Hawaii Univ., Col. Appl. Sci., Dept. Agr. Ann. Rpt., 3 (1920), pp. 29–31*).—Physical and chemical analyses of samples of typical soils from the farm of the University of Hawaii are presented.

The distribution of the most important agricultural soils in Germany, P. KRISCHE (*Die Verteilung der Landwirtschaftlichen Hauptbodenarten im Deutschen Reiche. Berlin: Franz Wunder, 1921, pp. 78, pls. 21*).—This is a general survey of the agricultural soils of Germany and is accompanied by a series of maps showing the location and distribution of the prevailing soil types. The survey shows that there are 7 great areas of prevailingly heavy

soils in Germany, 14 great areas of prevailingly light soils, and 6 great moor areas. It is stated that the soils of Germany may in general be considered as deficient in nitrogen. The light soils also are said to be generally deficient in nutritive constituents, especially the sand areas of north Germany and the moor areas.

The soils and water supply of the Mariut district west of Alexandria, W. F. HUME and F. HUGHES (*Cairo: Egypt Min. Finance, 1921, pp. [3]+52, pls. 12*).—This report deals with the soils and underground waters of the district of eastern Mariut, which is bounded on the north by the Mediterranean Sea and extends westward from Lake Mareotis to an ill-defined boundary in the neighborhood of El'Alamein. It includes studies of the physical and chemical composition of the soils and of the water.

The district appears to be a region of alternating ridges and depressions. The ridges are dunes composed of calcareous sand, the surfaces of which become solid limestone under the influence of evaporation. Owing to the activity of the wind the dune material has been spread far over the land, producing a marked uniformity of the soil throughout the greater part of the area. The clayey calcareous sands so produced are said to be 30 meters (98 ft.) thick in the uplands. The moisture content of the soil was found to increase rapidly with the depth. Examination of a large series of wells showed that water occurs almost invariably at a depth below the surface which agrees approximately with the height of the latter above sea level. In studies of the water it was found that the quality decreased from east to west. The same decrease occurred toward the Lake Mareotis area, where it is not closely bounded by steep dune ridges. Within the lake influence the underground water, wherever examined, was absolute brine. The best water was found close to the seashore and on the eastern and southern slopes on certain depressions.

It was found that a marked line of demarcation exists between the Mariut soils and those of Lake Mareotis, the change taking place below zero level. Above this level the ground is cultivable, while below it the soils are intensely salty and the water which lies close to the surface is practically brine.

A report by H. M. Heald is included on the dry-farming operations at the Bahig Experimental Station covering two seasons. The soils varied from a light calcareous loam to one containing more clay. Cultivating by steam tackle was found very unsatisfactory on account of the water supply, and tractors are recommended for this work. It is concluded that the calcareous sandy soil of the area can be successfully cultivated in some form whenever water is brought to it. Cultivation of the uplands by dry farming methods is not likely to be successful, owing to the extremely variable nature of the rainfall. The main possible method of extending the cultivation appears to be through the sinking of wells.

[Soils] (*Kentucky Sta. Rpt. 1920, pt. 1, pp. 21, 22*).—Studies of the availability of plant nutrients in soils as determined by digestion in dilute solutions of nitric acid have shown that the digestion of a large number of soils for 5 minutes in N/5 nitric acid brings into solution as much phosphorus and calcium as the customary 5-hour digestion with the same strength of solvent and nearly as much potassium, but does not appreciably influence the silicates. With some soils appreciably more phosphorus was dissolved by the shorter digestion than by the longer one. A small number of soils which had been in tobacco for two years in succession showed an appreciable diminution of easily soluble potassium by this method.

Pot experiments, comprising 126 pots, with soy beans, alfalfa, sweet clover, and oats on six types of soil, to test the effect of calcium compounds on plant growth in different soils, are said to have caused an increase of ash and cal-

cium content of the plants regardless of any increase in growth, although this was not true of the seed.

Tobacco soil investigation, H. A. FREEMAN (*Canada Expt. Farms, Tobacco Div. Interim Rpt., 1921, p. 9*).—It has been found that the best flue-cured tobacco soils are those having at least 80 per cent of sand, of which at least 40 per cent is medium sand, from 5 to 15 per cent silt, and from 1 to 8 per cent clay. The best soils for White Burley are the gravel and sand loams to loams containing from 50 to 70 per cent of sand, 10 to 20 per cent of silt, and 8 to 20 per cent of clay. The best soils for cigar tobaccos are the sands and fine sands to fine sandy loams. Chemically, the flue-cured tobacco soils are said to be the most deficient in plant nutrients and respond very well to commercial fertilizers. The White Burley soils studied require an abundance of manure, rotations, acid phosphate, and potash. The cigar tobacco soils investigated require abundant manure, rotations, and complete fertilizers.

Orchard soil management and fertilization, O. M. MORRIS and R. LARSEN (*Washington Sta. Pop. Bul. 121 (1921), pp. 23, figs. 2*).—Popular information is given on the management of orchard soils, based on investigational work in orchard soil improvement being conducted in Chelan County, Wash., under the direction of the station.

Analyses of representative orchard soil types of the county are reported and discussed, it being shown that each soil contains an abundance of phosphoric acid and potash and what is considered to be a good supply of nitrogen.

The experiments on the fertilization of orchard soils gave good results from the use of nitrogenous fertilizers on soils which had been clean-cultivated for a number of years and on which the trees lacked in vigor and productiveness. No pronounced results were obtained from the use of nitrogenous fertilizers on soils which had been successfully cover-cropped for more than three years. No benefits were obtained from the use of phosphatic or potassic fertilizers, either singly or combined with nitrogen. Barnyard manure was beneficial on both clean-cultivated and cover-cropped soils, especially on hard, compact soils of low moisture absorptive power. Fall use of fertilizers was more frequently successful than spring use.

It is concluded that immediate results may be secured on these soils by the use of readily available nitrogenous fertilizers.

Experiments in soil treatment in the Enterprise district, southern Rhodesia, H. B. CHRISTIAN (*Rhodesia Agr. Jour., 18 (1921), No. 4, pp. 405-410, pl. 1*).—Experiments on the treatment of a long strip of light red land of about 1,200 acres in extent in southern Rhodesia are reported. The area lies between the Umwindzi River and another small stream. The soil varies from 20 ft. in depth at the river banks to 50 ft. at the highest point between the two streams, and is remarkably uniform in quality throughout.

The test crop used for the various soil treatments was maize. The soil was well drained, and chemical analyses indicated that it contains very little humus, is markedly deficient in nitrogen, phosphoric acid, and lime, but contains a good average supply of potash.

When treated with lime alone the acidity was corrected in proportion to the quantity of lime applied, but the subsequent crop was not noticeably influenced owing to the lack of humus and of available phosphoric acid. Treatment with phosphatic fertilizers, including superphosphate, bone meal, and phosphatic guano, had no marked effect, which is attributed mainly to a deficiency in humus and nitrogen and to a lesser extent to acidity. In treatment with leguminous green manure alone in which velvet beans were used the effect on subsequent crop returns was not marked, which is attributed to a deficiency in phosphoric acid. No great effect resulted from treatment with

wood ash alone owing mainly to a deficiency of humus and nitrogen, although the results were better than when phosphatic fertilizers were used alone.

When leguminous green manures and wood ash were used together the effect was very marked. The effect of treatment with kraal manure was also marked, but not lasting.

Fertilizer experiments (*Landw. Jahrb.*, 51 (1918), *Ergänzungs.* 1, pp. 6-151).—This portion of this report brings together a large amount of statistical data on fertilizer experiments and the results of studies on the action of different artificial fertilizers and animal and vegetable manures.

Fertilizer experiment with hot composted stable manure, BORNEMANN (*Mitt. Deut. Landw. Gesell.*, 37 (1922), No. 3, pp. 38-41).—Experiments to determine the value of so-called hot composted stable manure and hot composted green manure as compared with ordinary stable manure and straw manure for potatoes are reported.

The utilization of the nitrogen from the hot composted stable manure was much greater than from ordinary manure. Both the composted stable and green manures produced considerably higher yields than the ordinary manures.

Conservation of liquid manure with waste gypsum, O. NOLTE (*Mitt. Deut. Landw. Gesell.*, 37 (1922), No. 3, pp. 41, 42).—Laboratory and plat experiments are reported on the value of gypsum for the conservation of the ammonia of liquid manure. It was found that the gypsum had little action on the ammonia of liquid manure, and cropping experiments with sugar beets showed that the untreated liquid manure gave as good results as the treated. It is concluded that gypsum is not a practical preservative for liquid manure.

The injurious action of straw fertilization and its prevention, O. RAHN (*Ztschr. Tech. Biol.*, 7 (1919), No. 3-4, pp. 172-186).—Studies are reported which showed that in normal agricultural soils the easily assimilable carbon is in minimum, therefore permitting the accumulation of ammonia and nitrates. When straw or other plant matter low in nitrogen was added, there was a marked increase in soil microorganisms resulting in the nitrogen content becoming in minimum. This condition persisted until all of the easily decomposable carbon compounds were destroyed. It is thought that the condition of nitrogen being in minimum occurs more easily and lasts longer in soils deficient in nitrogen than in soils rich therein. While this condition exists no nitrogen can be absorbed by plants.

It is concluded that when stable manure is used on soil in the ordinary manner a nitrogen minimum need not be feared, since the content of easily available nitrogen of the manure together with the soluble nitrogen compounds of the soil are sufficient to satisfy the demands of the straw destroying organisms. The end products of the anaerobic decomposition of straw were found to be a good source of carbon for many aerobes and probably also for denitrifying bacteria.

An injury of seedlings by toxic substances resulting from the decomposition of organic substances poor in nitrogen is considered to be improbable under the ordinary conditions existing in agricultural soils.

A comparative study of the value of nitrate of soda, leguminous green manures, and stable manure in cylinder experiments, 1907-1919, J. G. LIPMAN and A. W. BLAIR (*Jour. Agr. Sci. [England]*, 11 (1921), No. 3, pp. 323-336, pls. 2, fig. 1).—In a contribution from the New Jersey Experiment Stations, comparative studies by means of cylinder experiments, covering a period of 13 years, of the nitrogen of sodium nitrate, stable manure, and leguminous green manure crops on eight soil types are reported.

Three hundred and twenty cylinders were used, making it possible to run a 4-year rotation on the eight types of soil with five different treatments for

each type. The treatments included (series 1) no fertilizer, (series 2) mineral fertilizers only, (series 3) mineral fertilizers and leguminous green manure crops, and (series 4) mineral fertilizers and stable manure. All cylinders received liberal applications of ground limestone every five years. The rotation consisted of rye, corn, potatoes, and oats, all grown every year on the eight soils.

Under all the treatments the largest crops were obtained during the first two or three years of the period. From the point of maximum yield, which in most cases occurred within the first three years, there was a gradual decline in yields, both of total dry matter and total nitrogen. This decline, however, was not without some exceptions. Without exception the average yields for the 13 years were less than the average for the first seven years. Of the eight types of soil used, Quinton sandy loam consistently gave the largest crops and the largest nitrogen return, followed closely by Penn loam. Norfolk sand likewise consistently gave the lowest returns. Windsor sand showed a remarkable response to the green manure treatment.

Of the five different treatments the green manure series gave the highest average returns on all the soils, although in a few cases scattered through the 13 years, and for the majority of the soil types during the first two years, the sodium nitrate series gave the largest yield. In a very few cases the yield on the stable manure series exceeded that of the green manure series. The average yield of the nitrate series stood between the green manure and stable manure series.

These results are taken to indicate that for a period of 13 years nitrogen supplied by leguminous green manure crops, grown between the main crops of the rotation, was more effective in crop production than 15 tons of manure every two years, while at the same time the nitrogen content of the soil of the green manure series was maintained for a period of five years at least on a level with that of the stable manure series.

It was also shown that the green manure series yielded larger crops than the sodium nitrate series and at the same time maintained the nitrogen content of the soils at a higher level. It is pointed out that it may be possible to maintain crop yields at a rather high level even when the total nitrogen content of the soil is not kept at quite so high a level as was found in the original soil. Under such conditions, however, a constant turnover of readily available nitrogen is necessary.

Comparative action of ordinary ammonium sulphate and the double sulphate of ammonium and sodium (*Sta. Agron. Finistère et Lab. Dept. Bul., 1917-18, pp. 43-50*).—Pot and field experiments with clover and potatoes are reported which showed that sodium ammonium sulphate is toxic to clover. Ammonium sulphate is an active fertilizer for clover when applied after the clover is well developed, but when applied to clover at the time of seeding it has a toxic effect and prevents germination. The sodium ammonium sulphate had the same but a less marked toxic effect when applied at the time of seeding. It is concluded that the toxicity of ammonium sulphate for clover depends upon the stage of development, it being greatest when applied at the time of seeding and disappearing when the plant is 0.15 meter (about 6 in.) high.

No evidence was obtained that sodium sulphate is toxic to potatoes. It is concluded that the toxicity of sodium sulphate to plants is very feeble, and that when mixed with ammonium sulphate it will neither markedly injure plants nor reduce the fertilizing value of ammonium sulphate when used according to ordinary agricultural practice.

The transformation of ammonium carbonate with gypsum, B. NEUMANN (*Ztschr. Angew. Chem., 34 (1921), Nos. 68, Aufsatz., pp. 441, 442; 69, Aufsatz., pp. 445-447, figs. 5*).—Studies on the manufacture of ammonium sulphate by the

decomposition of ammonium carbonate solutions with gypsum are reported. Solutions of ammonium carbonate of from one-fourth to four times normal and gypsum of varying degrees of hydration, burned gypsum, and almost pure gypsum were used.

It was found that the transformation took place rapidly, although equilibrium was not reached until after from 15 to 20 hours. The yield of ammonium sulphate increased with the concentration of the ammonium carbonate solution. That the yield did not reach the theoretical amount is attributed to double salt formation. The yield was 85 per cent with dihydrated gypsum and with the half hydrated and burned gypsum 92 per cent. Heating to a maximum of 38° C. increased the yield where dihydrated gypsum was used up to 86 per cent. The transformation was not uniform where the burned gypsum was used. With a natural anhydrite containing about 98 per cent of gypsum, about the same results were obtained as with the half hydrated gypsum and much better results than with the dihydrate.

Recent nitrogen salts and their fertilizer action, ENGELS (*Mitt. Ver. Förd. Moorkult. Deut. Reiche*, 39 (1921), Nos. 23, pp. 424-429; 24, pp. 437-443).—A brief description is given of the manufacture, composition, action, and general properties of some of the more recent nitrogenous fertilizers, including lime nitrogen, nitrogen lime, calcium nitrate, ammonium nitrate, potassium ammonium nitrate, sodium ammonium nitrate, ammonium bicarbonate, ammonium sulphate nitrate, gypsum ammonium nitrate, urea, nitrate, and urea superphosphate.

The nitrogen requirement of Switzerland and the technical processes for production of nitrogenous fertilizers, O. NYDEGGER (*Schweiz. Chem. Ztg.*, 1921, Nos. 6, pp. 61-67; 8, pp. 89-94; 9, pp. 101-104).—The Haber, cyanamid, and arc processes of nitrogen fixation are discussed and compared. It is concluded that the electric arc process is the best suited to Swiss conditions.

The Bucher process for the fixation of nitrogen, M. DEK. THOMPSON (*Chem. and Metall. Engin.*, 26 (1922), No. 3, pp. 124-127, figs. 2).—An account is given of small- and large-scale experiments in the production of sodium cyanid from soda ash, carbon, and iron, and the results are compared with those of other investigators.

It was found that the finer the particles of iron and carbon used, the higher is the conversion of the sodium to cyanid form. The highest results were obtained with those forms of carbon that had very little ash, such as petroleum coke, lamp black, graphite, gas carbon, and charcoal. Coke with 10 per cent ash gave very poor results. The important result of the small-scale experiments was that the best conversion with iron flour was about 60 per cent. With iron scale as high as 76 per cent was obtained, both at the expense of very long milling. With precipitated iron oxid, which was reduced to finely divided iron in the furnace, 90 per cent conversion was reached. Details of furnace design are discussed.

Investigation with a mixture of Thomas meal and ammonium sulphate (Thomas ammonium calcium phosphate), E. HASELHOFF (*Fühling's Landw. Ztg.*, 69 (1920), No. 21-22, pp. 401-409).—Storage experiments with so-called Thomas ammonium calcium phosphate, a mixture of Thomas meal and ammonium sulphate, showed that under ordinary conditions of dry storage there is no appreciable loss of nitrogen. Pot experiments with different crops and on different soils showed that the mixture in general gave as good results as Thomas meal and ammonium sulphate used separately.

Rhenania phosphate and its fertilizer action, F. WEISKE (*Mitt. Deut. Landw. Gesell.*, 36 (1921), No. 47, pp. 667-669).—Experiments on soils of varying basicity to determine the fertilizing value of Rhenania phosphate for oats,

rye, rye grass, white mustard, rape, peas, bush beans, and vetch as compared with Thomas phosphate, superphosphate, and raw rock phosphate are reported.

Rhenania phosphate is a product of the fusion of finely ground raw rock phosphate with lime and phonolite and contains approximately 2.5 per cent of potash and from 25 to 30 per cent of lime. It showed about the same citrate solubility as Thomas phosphate. In about half of the cases these two gave practically the same fertilizing results. In the remaining cases the Rhenania phosphate gave superior results, as evidenced by higher yields and greater phosphoric acid assimilation. The utilization of the phosphoric acid of the Rhenania phosphate by crops corresponded approximately to its solubility in 2 per cent citric acid.

It was noted that the early growth of crops was especially improved by Rhenania phosphate. This is taken to indicate that at least a part of its phosphoric acid is in very available form. Apparently this fertilizer gave better results on the more basic soils.

Studies on the phosphoric acid requirements of soils, SCHNEIDEWIND (*Mitt. Deut. Landw. Gesell.*, 37 (1922), No. 4, pp. 56, 57).—Experiments with barley, potatoes, and sugar beets in six different localities in Germany, to determine the influence of phosphoric acid fertilization on soils which had previously received more or less prolonged stable manure treatment or regular fertilization with phosphoric acid, showed that the increases in yield due to phosphoric acid were in most cases very small. It is recommended that on such soils only sufficient phosphoric acid be applied to maintain the supply, and heavy phosphoric acid fertilization is considered unnecessary and wasteful.

Acid calcium carbonate as a regulator of soil transformations, E. RAMMANN and H. JUNK (*Deut. Landw. Presse*, 48 (1921), No. 82, pp. 612, 613).—Experiments are reported the results of which are taken to indicate that carbonic acid has a strong decomposing action on soil silicates, especially the colloidal silicates, and that the weathering of soil by free carbon dioxide tends to impoverish it in the most important mineral constituents. It is further concluded that the acid carbonate salts, such as calcium bicarbonate, by their buffer action, tend to prevent or decrease the decomposition of the colloidal silicates in soil by carbon dioxide and the resulting leaching out of valuable basic materials such as potash.

Gypsum in South Australia, R. L. JACK (*So. Aust. Geol. Survey Bul.* 8 (1921), pp. 83–118, pl. 1, figs. 6).—This report describes the gypsum deposits of South Australia and gives data on production and use.

It is stated that gypsum occurs in five main types in Australia, which include rock gypsum, granular and scattered crystalline material, seed gypsum, flour gypsum, and crystals of gypsum of very high purity. The gypsum deposits are very widely distributed throughout South Australia, and many are of special size and purity. The material is said to occur in such quantities and can be so cheaply mined that the governing factor, aside from quality, is transportation from deposit to market.

An outline of the uses of lime, M. E. HOLMES (*Chem. and Metall. Engin.*, 26 (1922), No. 7, pp. 294–300, fig. 1).—The essential feature of this paper consists in a graphic outline of the construction, agricultural, and chemical uses of lime.

The need for lime and how to meet it, I, II, B. H. BEDELL (*Jour. Min. Agr.* [London], 28 (1921), Nos. 3, pp. 200–206; 28 (1922), No. 10, pp. 869–880).—In the first article general information is given on the sources and use of lime on the soils of England. In part 2 a description is given of the principal features of the larger and permanent limestone grinding plants, and some particulars of lime-kiln construction and the process of lime burning are outlined.

The oxidation of sulphur by soil microorganisms, I, J. G. LIPMAN, S. A. WAKSMAN, and J. S. JOFFE (*Soil Sci.*, 12 (1921), No. 6, pp. 475-489).—Studies conducted at the New Jersey Experiment Stations are reported dealing mainly with an organism which oxidizes sulphur very rapidly. The methods used in the isolation of the organism are described, and an interpretation is given of these studies in terms of the changes produced by it in pure cultures.

From a study of the course of sulphur oxidation by the sulphur-oxidizing bacterium, it is concluded that in the presence of an excess of sulphur the pure cultures of the organism will convert at least from 86 to 94 per cent of the insoluble phosphate in tricalcium phosphate into water-soluble phosphate in a period of about 15 days under proper experimental conditions. After the fifteenth day it was found that the phosphate concentration in the solution reached an equilibrium, and the further oxidation of the excess of sulphur in the medium led to the accumulation of free sulphuric acid. This acted upon the soluble calcium phosphates, transforming them into phosphoric acid and both soluble and insoluble sulphates. The pH value of the medium gradually decreased and the titration acidity increased, accompanied by an increase in total sulphates. In 120 days the culture was found to be equivalent to 0.68 N acid.

The organism was grown on a medium for a period of eight months, but on consecutive transfer it was observed that it required a longer period of time to bring the reaction to the same point as indicated above. These studies indicated a definite deterioration of the sulphur-oxidizing capacity of the organism on continued cultivation in artificial liquid culture media.

Studies on the influence of initial reaction upon the growth of the organism showed that the reaction of the medium properly buffered and ranging from pH=2.8 to 2 gave the best growth, accompanied by a greater oxidation of sulphur as indicated by the range in pH and production of soluble sulphates. A reaction corresponding to the pH value of 5.6 and more was unfavorable for the development of the organism, while a reaction corresponding to a pH between these limits allowed a development of the organisms but apparently required a greater period of time for action.

These results are taken to indicate that the organism has its optimum conditions within the limits of reaction, roughly defined between pH=3 and 2. The growth is especially checked by the presence of an excess of insoluble alkaline calcium salts.

The sulphur oxidizing organism *Thiobacillus thiooxidans* is described as a short rod, with round edges, almost spherical, with a tendency to occur in pairs. It is less than 1 micron long and is about 0.5 micron in diameter. It is autotrophic, deriving its carbon from the carbon dioxide of the atmosphere and its energy from the oxidation of sulphur and thiosulphate. The presence of organic material is not injurious to its growth, and it can use ammonium salts and nitrates as sources of nitrogen.

Fertilization with sulphur, GERLACH (*Mitt. Deut. Landw. Gesell.*, 36 (1921), No. 52, pp. 726-728).—The results of three series of experiments on the fertilizing value of sulphur for oats and carrots on different soils are briefly reported, showing that the influence of sulphur on the yield was very small. The yield of oats was increased slightly on light sand soil and was slightly decreased on heavy loam soil. It is concluded that further studies of the subject are necessary to explain the favorable results obtained by certain investigators, and the use of lucern for this purpose is recommended.

The composition and agricultural use of ashes of quebracho colorado and of wheat bran, P. LAVENIR (*Cenizas de Quebracho Colorado y de Afrecho. Buenos Aires: Min. Agr. Nac., Dir. Lab. e Invest. Agr. Ganaderas, 1920, pp. 10*).—

Analyses of typical samples of the ashes of quebracho bark are reported and discussed. These indicate in one case a lime content of about 54 per cent and a potash content of 1.43 per cent. Another sample showed 1.98 per cent of potash and 2.41 per cent of lime soluble in water and 35 per cent of lime and 1.09 per cent of phosphoric acid soluble in acid. This material is considered to be of value mainly as a lime fertilizer, and its use in amounts of from 3 to 4 tons per hectare (1.2 to 1.6 tons per acre) on clay and heavy black soils is recommended.

Analyses of bran and bran ashes are also discussed. It was found that the combustion of bran yields from 5.78 to 7 per cent of ashes. These ashes contain about 4.08 per cent of lime, 11.8 per cent of magnesia, 18.08 per cent of potash, and 35.1 per cent of phosphoric acid.

Inspection of fertilizers, R. V. MAYO (*Inspección de Abonos, Informe Anual, 1920-21. San Juan: Porto Rico Dept. Agr. y Trabajo, 1921, pp. 17*).—This contains the text of the fertilizer inspection law of Porto Rico, and presents the results of actual and guaranteed analyses of 137 samples of fertilizers and fertilizer materials collected for inspection during the fiscal year 1920-21.

AGRICULTURAL BOTANY.

An introduction to cytology, L. W. SHARP (*New York and London: McGraw-Hill Book Co., Inc., 1921, pp. XIII+452, figs. 159*).—This book has been prepared chiefly for the purpose of giving a ready acquaintance with the literature and problems of cytology. Dealing mainly with the structural aspects of the subject, the work aims to make the prerequisite data of cell morphology more available. Throughout the book attention is focussed upon the protoplast, the cell wall receiving only brief consideration. The phenomena of nuclear division, chromosome reduction, and fertilization are described with considerable fullness, and their relation to the problems of heredity is taken up in five special chapters.

The subject is necessarily treated as containing many unanswered questions, the author attempting to indicate the present state of each and certain lines along which contributions to the subject may be hoped for.

The bibliography, given in connection with the several sections, is extensive, comprehending many aspects of the subject.

The origin of vacuoles in cells of some roots, A. GUILLIERMOND (*Compt. Rend. Soc. Biol. [Paris], 83 (1920), No. 12, pp. 411-414 figs. 10*).—A study of cell vacuoles in living root tip meristems of various plants (that of barley being very favorable to this purpose) in isotonic sugar solutions is described, the account featuring the behavior of the vacuolar content. This is said to respond to certain colorants by giving color reactions which appear to persist during the life of the cell. The formation, fusion, and other behavior of vacuoles is briefly noted, and two forms of mitochondrial elements are described. One of these bears a certain relation to the origin of the vacuole and is short lived, showing colorable figures which pass by fluidification into typical vacuoles. The other persists during the development of the cell and represents the chondriome as it exists in the animal cell. The vacuolar formations present, as regards their origin, a striking resemblance to the mitochondria. One suggested view herein discussed is that vacuoles result from the fluidification accompanying the chemical transformation of certain mitochondria.

Studies on chondriosomes in living cells, A. GUILLIERMOND (*Compt. Rend. Soc. Biol. [Paris], 83 (1920), No. 12, pp. 404-408, figs. 9*).—*Endomyces magnusii* offers in some respects a favorable opportunity to study in living cells the chondriosomes as regards their characters and behavior. This has been utilized by the author, who briefly details, with discussions, certain observations. The

chondriome in fungi presents the same characters as in cells of higher plants and of animals. It is absolutely distinct from the vacuolar system.

Mitochondria in animal and vegetable cells, G. MANGENOT and L. EM-BERGER (*Compt. Rend. Soc. Biol. [Paris]*, 83 (1920), No. 12, pp. 418-420, figs. 6).—This discussion relates mainly to phases of contributions by different authors regarding cell coloration and demonstration of chondriosomes, and the characters, behavior, and significance of these bodies in animals and in plants.

The coexistence in plant cells of two distinct varieties of mitochondria, A. GUILLIERMOND (*Compt. Rend. Soc. Biol. [Paris]*, 83 (1920), No. 12, pp. 408-411, fig. 1; noted in *Rev. Sci. [Paris]*, 58 (1920), No. 14, p. 437).—Observations on chondriosomes in cells of higher plants (peas) are cited as showing the existence of two varieties of these bodies. These have much the same forms during cell development, also in adult cells, but are distinguishable principally by the facts that the one becomes larger than the other, colors more readily, and produces starch grains which the other does not produce.

Studies of photosynthesis in fresh-water algae.—I, The fixation of both carbon and nitrogen from the atmosphere to form organic tissue by the green plant cell. II, Nutrition and growth produced by high gaseous dilutions of simple organic compounds, such as formaldehyde and methylic alcohol. III, Nutrition and growth by means of high dilutions of carbon dioxide and oxids of nitrogen without access to atmosphere, B. MOORE and T. A. WEBSTER (*Roy. Soc. [London], Proc., Ser. B*, 91 (1920), No. B 638, pp. 201-215).—Outlining hypotheses and observations on certain facts with an account of further experimentation (*E. S. R.*, 30, p. 129; 40, p. 426), the authors claim that the power still possessed by the lowest type of synthesizing cell, the unicellular algae, of fixing carbon and nitrogen, and of building these up into reduced organic compounds with uptake of energy (from sunlight), must have been possessed by the primeval living organism and by the inorganic colloidal systems which are assumed to have been its precursors. A synthesizing cell must have existed prior to bacteria and other fungi, since these exist only upon organic matter, which the primeval world could not contain before the advent of life. Their specific reactions show that even the ultramicroscopic filter-passing organisms are highly organized products on the path from the inorganic toward life, and it follows that there is a long intermediate range of evolution. The first synthesizing system acting upon the light was probably an inorganic colloidal system in solution, capable of adsorbing the simple organic substances which it synthesized. It is hence futile to search for the origin of life at the level of bacteria and torulae.

As complexity increased with progressive evolution, more and more rapid transformers for the capture of the energy of the sunlight came into existence. Such transformers are found in the green cell for fixation of both carbon and nitrogen. The earlier transformers in the inorganic colloidal systems can utilize light of short wave lengths only. The later transformers in the living cells are adapted to utilize longer wave lengths; the very short wave lengths, which are lethal, are cut off by their color screens of chlorophyll and other colorants.

The earliest products of photosynthesis, such as formaldehyde and methyl alcohol, are ordinarily very poisonous to the green cell. At sufficiently high dilution, however, these substances can be used as nutrition in the absence of carbon dioxide, and very marked growths have been obtained with these substances as the sole carbon source.

In the absence of all nitrogen sources except atmospheric nitrogen, but with abundance of carbon dioxide, unicellular algae can fix nitrogen, grow, and form proteins, though the rate of fixation and growth is greatly accelerated if

nitrites or nitrogen oxids are available. These oxids of nitrogen can be supplied in gaseous form from the atmosphere, and they are normally found in pure country air, especially in spring and summer.

Studies of photosynthesis in marine algae.—I, **Fixation of carbon and nitrogen from inorganic sources in sea water.** II, **Increase of alkalinity of sea water as a measure of photosynthesis**, B. MOORE, E. WHITLEY, and T. A. WEBSTER (*Roy. Soc. [London], Proc., Ser. B*, 92 (1921), No. B 642, pp. 51-60).—The results of these studies confirm and amplify those obtained by Moore and Webster, as noted above. Marine algae, like fresh water algae, can fix elemental nitrogen from water and thus indirectly from air, in sunlight but not in darkness. The bicarbonates of calcium and magnesium in sea water furnish abundant carbon dioxid utilizable for carbon fixation, and as fixation proceeds the sea water becomes more alkaline, the limit of alkalinity being reached when all the bicarbonates have become converted into carbonates, at which point the H-ion concentration has fallen below the value $pH=9.1$. In the strong sunshine of spring and summer this degree of alkalinity favors increased rapidity of cell division and results in abnormal and varying forms.

Marine algae grown in a limited volume of water and a limited supply of air in sunlight and full daylight fix both carbon and nitrogen rapidly into organic compounds. The amount of nitrogen fixed exceeds many times the total nitrogen originally present as amino, nitrite, or nitrate in the water. Moreover, the small initial amounts of nitrogen present in these forms are not decreased. It follows that the only available source is the free nitrogen of the atmosphere.

The action of light on colloidal chlorophyll in the presence of stabilizers, R. WURMSER (*Compt. Rend. Soc. Biol. [Paris]*, 83 (1920), No. 12, pp. 437, 438).—Studies on pure preparations of chlorophyll in the colloidal state, obtained by the method of Willstätter and Stoll (*E. S. R.*, 43, p. 525), led to the conclusion that plant chlorophyll is protected against the destructive action of light by the presence of colloids. Hypotheses and possibilities are suggested.

A vegetable oxidase acting on phlorizin, G. LEONCINI (*Staz. Sper. Agr. Ital.*, 53 (1920), No. 4-6, pp. 138-145).—It is claimed that there exists in parts of certain plants an oxidase capable of acting upon phlorizin, producing thus a substance the characters and behavior of which are briefly discussed.

The vascular anatomy of normal and variant seedlings of *Phaseolus vulgaris*, J. A. HARRIS and E. W. SINNOTT (*Natl. Acad. Sci. Proc.*, 7 (1921), No. 1, pp. 35-41, figs. 4).—The investigations here summarized comprise a comparative and biometric study of the gross vascular anatomy of normal and variant seedlings of *P. vulgaris*. Three morphological types are considered, namely, the normal or dimerous seedling with two cotyledons and two primordial leaves, the trimerous seedling with three cotyledons and three primordial leaves, and the hemitrimerous seedling with three cotyledons and two primordial leaves. Four main groups of problems as to the vascular topography of these seedling types have been taken up biometrically, (1) the number of bundles at different levels in the seedling, (2) the variability in bundle number, (3) the differentiation in internal structure of seedlings which are externally dimerous, trimerous, or hemitrimerous, and (4) the interrelationship of bundle number in different regions of the seedling. The data are presented in tabular and graphic form with brief discussion.

It appears that there is a complete reorganization of the vascular system at the cotyledonary node. It is evident that the vascular structures of the seedling are not constant but are highly variable within genetically very homogeneous material. Seedlings differing in external form are differentiated in their internal anatomy. Such differentiation is evident not only in the

mean number of bundles but in the degree of variability in the bundle number. The external form and the internal structure of the seedling are highly but not perfectly correlated. Finally, in both normal and variant seedlings, the number of vascular elements of the several regions of the seedling are correlated in very different degrees, the correlation between some being high, while between others it is practically wanting.

The vascular anatomy of dimerous and trimerous seedlings of *Phaseolus vulgaris*, J. A. HARRIS, E. W. SINNOTT, J. Y. PENNYPACKER, and G. B. DURHAM (*Amer. Jour. Bot.*, 8 (1921), No. 2, pp. 63-102, figs. 23).—The present paper gives a portion of the results of the biometric analysis of a comparatively simple morphological problem, that of the gross vascular anatomy of certain normal and abnormal bean seedlings. The purpose was to study the vascular anatomy of normal and abnormal seedlings from the point of view of descriptive morphology—a preliminary believed to be essential to a sound interpretation of statistical results; to study statistically the number and variation of the vascular elements in different regions of the seedlings; and to investigate the correlations between these internal characters (such as those which exist between bundle number in different regions of the seedling) and between the internal characters and the external features of the plant. The results of the first and the second phase of the investigation are detailed in the present paper.

It is stated that external differentiation such as that which characterizes dimerous and trimerous seedlings of *P. vulgaris* is accompanied by profound differences in internal structure. Anatomical characters are by no means constant, varying greatly even in series of individuals which are genetically highly homogeneous. Variation in anatomical structure is not constant for the plant as a whole, but may differ from region to region or from organ to organ. The results of this study emphasize the importance of using both biometric and comparative methods to supplement each other in any attack upon the problems of general morphology or of morphogenesis.

Correlations between anatomical characters in the seedling of *Phaseolus vulgaris*, J. A. HARRIS, E. W. SINNOTT, J. Y. PENNYPACKER, and G. B. DURHAM (*Amer. Jour. Bot.*, 8 (1921), No. 7, pp. 339-365, figs. 8).—This paper presents results of the third portion of the investigation noted above, considering in quantitative terms the degree of interrelationship existing between the vascular structures in the different regions of normal and of abnormal seedlings.

The results as presented in tabular and graphic detail, with discussion, are considered to justify emphasis of the facts that the vascular structures of the seedling are not constant but are decidedly variable within the species, showing different degrees of variability within the individual organism; that seedlings differing in external form are profoundly differentiated in their internal anatomy as to both bundle number and degree of variability thereof (external form and internal structure being thus highly but not perfectly correlated); and that the different anatomical characters of the seedling are interrelated with degrees of intensity which vary greatly.

The vascular anatomy of hemitrimorous seedlings of *Phaseolus vulgaris*, J. A. HARRIS, E. W. SINNOTT, J. Y. PENNYPACKER, and G. B. DURHAM (*Amer. Jour. Bot.*, 8 (1921), No. 8, pp. 375-381).—The purpose of this paper is a comparison of the gross vascular anatomy of hemitrimorous seedlings of *P. vulgaris* with those which are trimerous or dimerous, these terms being used here as in the papers above noted.

It appears that in internal structure the hypocotyl of the hemitrimorous seedling is practically identical with that of a trimerous seedling with which it has in common a whorl of 3 cotyledons. The epicotyledonary internode in the

hemitrimerous seedling, limited by a trimerous cotyledonary and a dimerous primordial node, is intermediate in anatomy between the trimerous and dimerous types.

Investigations on the hardening process in vegetable plants, J. T. ROSA, JR. (*Missouri Sta. Research Bul.* 48 (1921), pp. 5-90, pls. 7, figs. 9).—This study was undertaken as one of the phases of a project on the transplanting of vegetable plants, and since the hardening process resulted in a condition of acquired hardness, the experiments are believed to throw considerable light on the general problem of cold resistance in plants. Cabbage was used as a representative type of plant which is capable of being hardened so as to withstand considerable ice formation within the leaves, and the tomato was used as the representative of a type of plant which can not be so hardened as to withstand ice formation. Lettuce, cauliflower, kale, celery, peppers, eggplants, and sweet potatoes were other plants investigated.

The data show that the hardening process in plants is accompanied by a marked increase in water-retaining power, and that this water-retaining power is due chiefly to the imbibitional forces of the cell. The amount of water frozen in hardy plants is less than in tender plants, and cells of hardy plants were found to retain a larger amount of unfrozen water than those of tender plants. It is believed that cold resistance in plants is due to the increased water-retaining power of the cells, and the increased water-retaining power is associated with increased moisture content, increased amount of hydrophilous colloids, such as pentosans, increased water-retaining power of such cell colloids, and increased amount of osmotically active substances as soluble sugars. The marked parallelism between pentosan content and hardness is believed to indicate a causal relationship, although the pentosan content alone can not be taken as an absolute index of cold resistance. Salt content, acidity, hydrogen-ion concentration, sugar, moisture, protoplasmic colloids other than pentosans, etc., may influence water-retaining power and hardness.

It is believed that the fundamental difference between hardy and tender species lies in their ability to initiate changes whereby the stability and water-retaining power of the protoplasm and consequently hardness are increased. Hardy species and varieties are said to possess the ability to initiate such changes to a greater or less great degree, while tender species possess it to a very slight degree or not at all.

In view of the connection between cell water-retaining power and hardness which has been found and the correlation between soluble pentosan content and hardness, it appears that selection of plants for high soluble pentosan content may be helpful to the breeder of cold-resistant, drought-resistant, or disease-resistant varieties of crop plants.

The growth of seedlings in wind, L. HILL (*Roy. Soc. [London], Proc., Ser. B*, 92 (1921), No. B642, pp. 28-31, pls. 2).—The striking effect of wind, as noted in Patagonia in stunting plant growth, suggested these varied experiments on the effect of artificially produced wind on the germination and growth of bean and cress seedlings. Shaking due to the motor was evidently not a factor. The conclusion reached is that the stunting effect produced by wind is due not only to a less favorable wetting but also to greater cooling. The growing point may be robbed by wind of heat which is produced in the cellular growth processes.

Effects of mutilating the seeds on the growth and productiveness of corn, E. B. BROWN (*U. S. Dept. Agr. Bul.* 1011 (1922), pp. 14, pls. 3).—Experiments are reported on the effect of the mutilation of the embryo on the germination of corn, the investigations being carried on mostly under field conditions. The purpose of the study was to determine the effects upon growth

and productiveness that may be expected in a general way to result from the use of seed which from various causes is deficient in food reserves.

Seeds of white dent corn were prepared by removing the hulls, cutting off the soft starchy part of the seed, and the entire removal of the endosperm. The effects of such mutilations were shown in the reduced stands of mutilated seed, smaller seedlings, retarded development of the plants, and reduction in the average number of ears and the average weight of the ears produced from mutilated seed. The reductions were said to be equivalent to 7 to 10 bu. per acre.

Respiration of shelled corn, C. H. BAILEY (*Minnesota Sta. Tech. Bul.* 3 (1921), pp. 3-44, figs. 12).—On account of its bearing on the problem of the heating of corn in storage and in transit, the author made a study of the respiration of shelled corn as affected by various factors. The moisture content was found in a large measure to determine the rate of respiration of sound corn stored under uniform temperature and other conditions. Acceleration of respiration with increasing moisture content was found to become marked when the moisture exceeded 13 per cent, and increased about 400 per cent between 15 and 17 per cent of moisture.

During the curing of corn on the cob immediately after harvest, the rate of respiration was found to be lower for a time than that of corn of the same moisture content later in the season, and this is believed to indicate a form of dormancy resulting from a reduced rate of diffusion of oxygen into the respiring cells, or of carbon dioxid therefrom, or both. Cracked and broken corn kernels respire more vigorously than sound, normal kernels, and there is said to be an increased risk involved in storing and transporting corn containing appreciable quantities of broken grain. Sprouted kernels when dried yielded a higher rate of respiration than sound, ungerminated kernels of the same variety and moisture content. Heat damaged and sour and heating corn also respired more vigorously than sound corn containing the same percentage of moisture. Such grain consequently presents a greater hazard in commercial handling and storage than sound grain of the same moisture content.

Temperature was found to affect the rate of respiration, an increase of 10°, from 27.8 to 37.8° C. (82 to 100° F.), nearly doubling the rate throughout the range of moisture studied.

Studies in pollen, with special reference to longevity, H. E. KNOWLTON (*New York Cornell Sta. Mem.* 52 (1922), pp. 751-793).—The results are given of a study of pollen and pollen longevity under different storage conditions as the reason for pollen mortality. The studies were carried on principally with pollen of snapdragon, corn, and apple.

Pollen of snapdragon was found to germinate in any concentration of cane sugar up to 30 per cent. The most favorable concentration for germination varied from 10 to 25 per cent, with the most favorable temperature about 25° C. and a moisture content of 10 to 20 per cent. Cane sugar is said to be the chief reserve carbohydrate in snapdragon pollen. Pollen of this species remains viable longest under temperatures of from 0° to -17°. The maximum duration of germinative ability was 670 days, and of fertilizing power 161 days. The death of *Antirrhinum* pollen is said to be not due to desiccation, exhaustion of stored food, or weakening of essential enzymes.

Corn pollen was found difficult to germinate. The optimum concentration for germination varied somewhat but took place at about 15 per cent cane sugar solution plus 0.7 per cent agar, with the moisture content between 50 and 60 per cent. The chief reserve carbohydrate in corn pollen was found to be starch. Corn pollen retained its viability longest at temperatures of 5 to 10° and was killed at a temperature of -17°. The death of corn pollen is said to be

caused by desiccation. It was found that pollen may germinate in an artificial medium and yet be incapable of fertilizing flowers.

The destruction of the elm by poison gases in war, R. GRAFFIN (*Compt. Rend. Acad. Agr. France*, 6 (1920), No. 24, p. 609; *abs. in Internatl. Inst. Agr. [Rome], Internatl. Rev. Sci. and Pract. Agr.*, 11 (1920), No. 9, p. 1055).—The elm appears to be extraordinarily sensitive to poisonous gas. This is evidenced by the number of dead elm trees in the Argonne showing no other form of injury. This area, moreover, was not bombarded until November, 1918, and was then exposed only for a short time. Age appears not to be a factor, and the same is true of the density or sparseness of growth.

Mycological communications, I, E. GÄUMANN (*Bul. Jard. Bot. Buitenzorg*, 3. ser., 3 (1921), No. 2, pp. 121–127, figs. 4).—In the first of a series of descriptions of new or revisions of old species, the author lists with brief discussion the new species *Triphragmium trevesiae* on *Trevesia sundaica*, *Gloeosporium tremellinum* on *Photinia notoniana*, and *Ravenelia erythrinae* on *Erythrina velutina*, and the species *Hamaspora gedeani* (*Phragmidium gedeanum*), said to have been described previously by Raciborski in 1909 as on *Rubus alpestris* from specimens which now appear to have been lost from collections both in Europe and in Buitenzorg.

FIELD CROPS.

The agronomic placement of varieties, C. A. MOOERS (*Jour. Amer. Soc. Agron.*, 13 (1921), No. 9, pp. 337–352, figs. 11).—With a view to scientific accuracy, the author emphasizes the need of improvement in the conduct of varietal trials, particularly as to the proper stand for each variety, a standard variety, and the employment of soils representative of productivity conditions of the region to which the results are to be applied. The determination of the productive vigor of every important variety over its possible territorial range is also considered desirable.

Nine simple relationships apparently existing between varieties of corn with regard to grain production on soils differing in productivity are described. Data from date-of-planting experiments enabled the plotting of a curve by means of which the approximate date of ripening of a variety can be predicted with fair accuracy. The curves obtained from an early, a medium, and a late maturing variety appeared to be arcs of circles with equal radii, but with different centers. A practical method of calculating the most favorable number of plants per acre has been evolved (*E. S. R.*, 42, p. 632).

Recommended standards for field experiments with farm crops, A. T. WIANCKO, A. C. ARNY, and S. C. SALMON (*Jour. Amer. Soc. Agron.*, 13 (1921), No. 9, pp. 371–374).—The standards recommended by the committee on standardization of field experiments (*E. S. R.*, 42, p. 529) specify conditions for the seed, the soil, the plats, check plats, replication of plats, removal of outside rows, mechanical operations, yield determination, and the publication and interpretation of results. Additions to the bibliography include 11 titles.

Varietal nomenclature of oats and wheat, G. STEWART (*Jour. Amer. Soc. Agron.*, 13 (1921), No. 8, pp. 318–323).—The author contends that unwieldy, troublesome, or extravagant varietal names should be replaced by simple ones, if at all in keeping with the popularity or historic justice of any given name. Numbers should be dropped from the name of a commercial variety, notwithstanding their necessity in experimental work.

Handbook of breeding of agricultural plants, C. FRUWIRTH (*Handbuch der Landwirtschaftlichen Pflanzenzüchtung*. Berlin: Paul Parey, 1922, vol. 2, 4. ed.,

rev. and enl., XVI+274, figs. 56).—A revised and enlarged edition of the volume noted heretofore (E. S. R., 45, p. 35), covering the breeding of corn, fodder beets, and other root crops, oil-seed plants, and grasses.

Seed selection on the farm, R. R. CHILDS (*Ga. Agr. Col. Bul. 241* (1921), pp. 16, figs. 9).—Practical instructions for improvement by selection of cotton, corn, wheat, oats, barley, rye, peanuts, velvet beans, cowpeas, and sweet potatoes.

Effect of electricity on plant growth (*Kentucky Sta. Rpt. 1920, pt. 1, pp. 29, 30*).—In further tests (E. S. R., 43, p. 824), electrified plats produced 12 pk. of dry beans, 24 bu. of potatoes, 239 lbs. of tomatoes, and 1,190 lbs. (per acre) of tobacco, as compared with 12 pk., 12 bu., 258 lbs., and 1,270 lbs., respectively, on the nonelectrified area.

Fallow experiments in south central Montana, A. E. SEAMANS (*Montana Sta. Bul. 142* (1921), pp. 24, figs. 4).—Experiments with the time of plowing and subsequent cultivation of fallow as a preparation for spring and winter wheat were in progress at the Huntley Experiment Farm in cooperation with the U. S. Department of Agriculture during the period 1915 to 1920, inclusive (E. S. R., 46, p. 724). Meteorological data secured during the period 1911 to 1920 are tabulated. Fallowing experiments at the Judith Basin Substation have been noted (E. S. R., 45, p. 339).

Spring wheat on stubble, fall plowed and kept cultivated during the winter and following summer, averaged 16.8 bu. per acre, on fall-plowed fallow left rough over winter 18.8 bu., spring-plowed fallow 18.4 bu., and early summer plowed fallow 16.3 bu. Winter wheat on land similarly treated yielded averages of 28.2, 31.4, 24.3, and 23.5 bu. per acre, respectively.

Barneyard manure applied to fallow ground preceding winter and spring wheat did not materially increase yields in comparison with these crops on unmanured fallow. The average yields of small grains, except barley, produced on land into which green manure was plowed were somewhat less than from ordinary fallow.

Small grains in a two-year rotation with fallow averaged less per acre than when following fallow in a rotation with other crops. Small grains on corn ground generally produced yields somewhat lower than after fallow but greater than when grown continuously on the same land. When the corn crop was also taken into account, the total profits per acre were generally greater where small grains were produced on corn land than where the grains were grown on summer fallow. It is thought that the degree of substitution of corn growing for fallow will depend upon the extent to which the corn can be utilized. In most cases this will necessitate a system where live-stock production is associated with grain farming.

Methods of applying inoculated soil to the seed of leguminous crops, A. C. ARNY and F. W. MCGINNIS (*Jour. Amer. Soc. Agron.*, 13 (1921), No. 8, pp. 289-303).—Tests of the various methods used in inoculating seed of legumes (E. S. R., 33, p. 633) were conducted at the Minnesota Experiment Station.

The use of water alone, and of 5 per cent solutions of furniture glue and of sugar caused the adherence of from 4.5 to 5 lbs. of dry, sifted soil to a bushel of soy-bean seed, 20 per cent solutions of the materials somewhat more, and 30 per cent solutions from 5.6 to 8.8 lbs. The amount of soil adhering per bushel of alfalfa seed ranged from 5.1 to 12.6 lbs. Inoculation varied with the crop, the soil, and growing conditions.

Where water alone, or glue and sugar solutions were used with soil as the inoculant, the plants generally possessed few, small, and scattering nodules, or even none. The plants were uneven, many appearing similar to the controls. Inoculation in this manner is not advised.

Equal amounts of soil and seed generally gave satisfactory inoculation as indicated by the appearance of large nodules grouped about the upper part of the taproot, particularly in the soy beans, and a dark green, thrifty growth above ground. The commercial culture, with few exceptions, gave results similar to and often more marked than from the use of the same amount of soil as seed.

Storing the seed in a suitable place for a short time after the inoculant was applied did not generally result in a serious lowering of the number of nodules per plant. Exposing the soil to sunlight for 0.5 to 5 hours in October and exposing the commercial culture for a half hour did not alter the efficiency of these inoculants for soy beans. For alfalfa some reduction in efficiency was apparent where the soil was exposed for 5 hours and where the commercial culture was exposed a half hour. It is recommended that exposure be avoided wherever possible.

[Report of field crops work in Bihar and Orissa, 1920-21], E. L. TANNER ET AL. (*Bihar and Orissa Agr. Dept. Rpt. 1921*, pp. 3, 11, 12, 14, 15, 16, 17, 18, 19, 21, 22, 23).—The continuation of various experiments with field crops is described as heretofore (*E. S. R.*, 46, p. 227).

Alfalfa (*U. S. Dept. Agr., Dept. Circ. 113 (1920)*, pp. 6).—Cultural and field practices adapted to growing the crop in Michigan, Wisconsin, and Minnesota are outlined, with notes on several commercial varieties.

A classification of the cultivated varieties of barley, R. G. WIGGANS (*New York Cornell Sta. Mem. 46 (1921)*, pp. 369-456, pls. 5, figs. 22).—The classification is offered to aid agronomists, seedsmen, and farmers in identifying the varieties of barley commonly cultivated and to clear up the misuses of nomenclature. The morphology of the barley plant is discussed in considerable detail, together with descriptions of the more important taxonomic characters and their uses in this and in previous classifications. Considerable space is devoted to reviewing the various classifications presented earlier.

In the present classification, 60 varieties have been distinguished in the 4 cultivated species of barley, as follows: Twenty-nine in *Hordeum vulgare*, 3 in *H. intermedium*, 20 in *H. distichon*, and 8 in *H. deficiens*. The varieties in each species are arranged systematically according to stable morphological characters and, as far as possible, according to natural adaptation. The varieties as described are separated by one or more morphological characters proving constant for a period of 5 years under New York environment and probably constant under all environmental conditions. In the keys, the choice of a name for a given variety was based in order on the frequent occurrence of a well-known name, names indicating geographical origin, descriptive names, and names of producers, discoverers, or introducers. Selection numbers were employed when no name was available and the specimen had been separated on the basis of some stable morphological character. Yield was not considered in this classification.

Tests of German brewing barley varieties in 1920, C. VON ECKENBRECHER (*Wchnschr. Braun.*, 38 (1921), Nos. 15, pp. 67-69; 16, pp. 74-76; 17, pp. 81, 82; 18, p. 88; 19, pp. 89-94).—Heils Improved Franconian barley and Bethges No. 2 led in average brewing quality in trials of brewing barleys conducted at 22 experimental centers in Germany in 1920.

Natural and artificial selection of red clover, E. LINDHARD (*Ztschr. Pflanzenzücht.*, 8 (1921), No. 2, pp. 95-120, figs. 4).—A discussion of the respective influence of environmental conditions, selection by man, and the visits of bees as factors in the development of the several types of red clover. Experiments to determine the effect of bees visiting the blossoms on seed production have been noted from another source (*E. S. R.*, 45, p. 825).

Seed production in red clover, F. SCHLECHT (*Ztschr. Pflanzenzücht.*, 8 (1921), No. 2, pp. 121-157, figs. 3).—The investigations reported concerned self- and close-pollination of red clover, the activities of bumblebees and honeybees as red clover pollinators, and observations on other factors involved in seed production in this crop.

Spontaneous self-fertilization of red clover is not considered possible. Artificial self-pollination or the use of pollen from flowers on the same head was fruitless, and interpollinating plants propagated vegetatively by root division did not generally give more seed than pollinating within the same plant. Pollen tubes ranged from 5.2 to 11 mm. in length, averaging 8.71 mm., with the largest heads generally containing the longest tubes. The tubes in the second cutting were somewhat longer than in the first, probably due in part to climatic conditions and soil fertility. A retrogression was noted in the third cutting.

Fertilization by honeybees under gauze enclosures was about 4.5 per cent greater than occurred in plants in the open. Honeybees appeared to be better pollinators than bumblebees in large gauze cages, as they did not break out and the pollen was practically pure. Single bees in small cages failed to pollinate.

Contrary to observations of Martin (E. S. R., 29, p. 829), high atmospheric humidity showed only a slight influence on seed production. Both seed cells in the ovary were found able to mature seed, but pods with one seed were far more prevalent. Seed from double pods were smaller as a rule, and about one-fifth lighter in weight than those from single pods. While double seed pods contained more shriveled seed, striking differences in germinability were not observed.

A plant disease, *Botrytis antherarum trifolii*, which completely destroys the anthers of red clover is described.

The origin, administration, and program of the Experimental Station for Corn Culture, T. V. ZAPPAROLI (*Bergamo Staz. Sper. Maiscult.*, Pub. 1 (1921), pp. 35, figs. 4).—An outline of the proposed activities of the Experimental Station for Corn Culture at Bergamo, Italy.

Selecting seed corn according to market standards, W. L. FRANK (*Grain Dealers Jour.*, 48 (1922), No. 4, p. 269).—Experiments by the author indicate that certain ear and kernel characters affect the market grades of shelled corn. Determinations were made on ears of four varieties from four widely separated localities and differing in indentation, rowing, shape, and tips.

Smooth-dent ears, ears with kernels in straight rows, and ears with filled tips, respectively, gave higher test weights per bushel than rough-dent ears, ears with twisted rows of irregular kernels, and ears with exposed cob tips. Shallow kernels tested higher than deep kernels and thick kernels higher than thin, flat kernels. Kernels from the tips, butts, and middles ranked in the order given. On the basis of test weight per bushel, 91 per cent of the smooth ears graded No. 1 and none below No. 2. Over 70 per cent of the rough-dent ears did not grade better than No. 2 and 37.5 per cent No. 3 or lower. All of the smooth-dent ears with shallow kernels, 66 per cent of all ears with shallow kernels, and 58 per cent of all deep kernels (including smooth-dent deep kernels) graded No. 1.

Cultivation experiments on corn (*Kentucky Sta. Rpt.* 1920, pt. 1, pp. 26, 27).—The 10-year average acre yields of corn cultivated shallow or deep, 3 to 4 or 6 to 8 times, ranged only from 55.5 to 56.2 bu. as compared with 52.9 bu. where weeds were scraped, without cultivation. Weeds were kept down to practically the same extent by all methods. It is concluded that any cultural method suppressing weeds effectively is satisfactory on the loam soil of central Kentucky.

Cotton: Ratooning experiments, J. P. OOSTHUIZEN (*Union So. Africa Dept. Agr. Jour.*, 4 (1922), No. 2, pp. 125-131, figs. 4).—The yields of ratooned cotton

in experiments at the Rustenburg Experiment Station decreased each year after planting, and the lint from ratooned crops showed signs of deterioration and of becoming shorter in staple. Slight increases found in ratooned fields were deemed the result of soil and climatic conditions rather than ratooning.

Studies by G. C. Haines in various parts of the Union showed the average bollworm infestation to be less than 5 per cent for first year fields and about 15 per cent for ratooned fields.

Frequency and importance of five-lock bolls in cotton, H. DUNLAVY (*Jour. Amer. Soc. Agron.*, 13 (1921), No. 8, pp. 332-334).—The 5-lock bolls of Acala cotton grown in 1920 near Italy, Tex., averaged 11.24 per cent heavier than the 4-lock bolls. Twenty-four individual plant rows of Acala produced in the first, second, and third pickings 87.1, 78.2, and 62.4 per cent of 5-lock bolls with individual rows ranging from 64.2 to 100, 53.2 to 94.2, and 35.1 to 96.7 per cent, respectively. The average of all plants at all pickings was 73.4 per cent of 5-lock bolls, ranging from 51.5 to 95.9 per cent.

The Bundelkhand cottons: Experiments in their improvement by pure line selection, B. C. BURT and N. HYDER (*Agr. Research Inst. Pusa Bul.* 123 (1921), pp. 15).—The important indigenous commercial cottons of Bundelkhand are described, with notes on pure line selections. The best selection, J. N. 1, had a lint length of $\frac{7}{8}$ in., was suitable for 16s to 18s warps and 20s wefts as compared with 10s to 12s for ordinary "deshi" cottons, and had a ginning percentage of 36. It was characterized by comparatively high yields in wet seasons.

Meade cotton, an upland long-staple variety replacing Sea Island, G. S. MELOY and C. B. DOYLE (*U. S. Dept. Agr. Bul.* 1030 (1922), pp. 24, pls. 11).—Meade cotton (*E. S. R.*, 40, p. 237) is considered a desirable substitute for Sea Island, the production of which has declined rapidly since the arrival of the boll weevil in the Sea Island cotton districts. Comparative field trials with the two varieties are described, the work of increasing the seed supply and extending the cultivation of Meade is outlined, and suggestions are made for growing and handling profitable crops of Meade cotton.

Meade, an early-maturing upland variety, produces under favorable conditions a fiber $1\frac{1}{8}$ in. long, of fine texture and quality, and remarkably like Sea Island, and by reason of its nearly smooth seeds can be handled on the regular Sea Island gins. A seed grid designed to handle the large Meade seeds can be adjusted to these gins, or the old grids may be used successfully by moving them 0.5 to 0.75 in. back from the hacker bar. Experiments carried on since 1916 in the Southeastern States have shown that at least twice as much Meade as Sea Island cotton, and not less than the short-staple varieties, can be produced under the same conditions. The fiber has been sold on the regular Sea Island markets on an equality with or even at a premium over the Sea Island fiber.

Spinning and manufacturing tests of Meade in comparison with both Sea Island (*E. S. R.*, 45, p. 38) and Egyptian cottons showed that the difference between these fibers, especially in the finer yarns, is practically negligible. Although the percentage of waste for Meade is somewhat higher with the same organization of spinning machinery, such waste may be materially reduced by slight changes of adjustment.

The successful substitution of Meade for Sea Island will depend largely upon the extent of cooperation developed between the farmers and the ginner to establish and maintain a supply of pure seed. Until communities of farmers organize for the purpose of growing only Meade cotton and to keep up its standard by continued selection and careful ginning on a locally controlled

gin, it is thought that individual farmers with private ginning equipment must produce enough pure seed to supply the whole section.

Cottonseed mixing increased by modern gin equipment, W. W. BALLARD and C. B. DOYLE (*U. S. Dept. Agr., Dept. Circ. 205 (1922), pp. 12, pl. 1*).—Supplementing earlier work (*E. S. R.*, 33, p. 833), this gives the results of a similar test, but with a more recent type of ginning equipment. The causes of cottonseed deterioration are cited, the mixing of seed in the roll box is described, and attention is called to the need of cooperation in order to maintain superior varieties.

It was shown by means of the stained seed method that modern ginning equipment as commonly operated may mix the seed to about 26 per cent in the bale after the ginning of one variety, some admixture being found in the seed of the second and even the third bale. The use of stained seed in the screw conveyor indicated that the exchange or gradual replacement of seed in the conveyor is slower than in the roll box of the gin stand.

Distribution of cotton seed in 1921, R. A. OAKLEY (*U. S. Dept. Agr., Dept. Circ. 151 (1920), pp. 16*).—The characteristics and origin are given of the Lone Star, Trice, Columbia, Durango, Meade, and Acala varieties of cotton, together with an introductory statement, *Improvement of the Cotton Crop by Selection*, by O. F. Cook.

[Flax production in Ireland in 1920] (*Flax Supply Assoc. Ireland, Ann. Rpt.*, 53 (1920), pp. 61).—Tabulated statistics indicate the acreage, production, and commercial movement of flax and flax products in Ireland and Great Britain in 1920, together with considerable data relative to the flax, jute, and hemp industries throughout the world.

Indian trade inquiry.—Reports on jute and silk, C. C. McLEOD ET AL. (*London: Imp. Inst.*, 1921, pp. IX+90).—The report on jute (pp. 1-32) comprises a general discussion of jute production and commercial movement in India of jute, allied fibers, and jute substitutes. Production and trade statistics covering the period 1911-1917 are appended.

Productive methods for oats in Missouri, C. A. HELM and L. J. STADLER (*Missouri Sta. Circ. 105 (1922), pp. 16, fig. 1*).—Based on results of cultural and varietal trials (*E. S. R.*, 46, p. 326) at the station and on outlying experimental fields, methods are outlined for the cultivation of oats for grain, for hay, as a nurse crop for clover and grass, and in mixtures with other crops. The use of barley and soy beans as substitutes for oats in cropping systems is discussed. The characteristics of the seasonal groups of oats varieties are given, together with brief descriptions of the varieties recommended for the State. Adaptation, purity, and seed-borne diseases are touched upon briefly.

Rules: Southeastern Peanut Association (*Atlanta, Ga.: Southeast. Peanut Assoc.*, 1921, pp. 29).—These regulations, effective October 1, 1921, govern transactions in farmers' stock peanuts, shelled peanuts, and peanut oil, soap stock, cake, meal, hulls, and miscellaneous peanut products.

Describing the potato, J. BROILL (*Fühling's Landw. Ztg.*, 70 (1921), No. 11-12, pp. 222-232).—The author presents a scheme for the easy and accurate description of potato seedlings.

Hybridization studies with potatoes, L. VON GRAEVENITZ (*Landw. Jahrb.*, 55 (1921), No. 4-5, pp. 753-815, figs. 10).—These experiments reported posthumously by E. Stein comprised hybridization studies with both wild and cultivated types of potatoes. As bagging the flowers with parchment did not give desirable results, the studies were conducted in a structure roofed with greenhouse sash, and with sides of wire screen, which gave a fair approximation to natural conditions.

It was noted that the pedicels bent downward following fecundation. With increased humidity, flowering was more abundant and the blossoms fell off less frequently. Repeated selfing led to degeneration of the reproductive organs, rendering the sexual production of pure lines very difficult. Under the climatic conditions at Potsdam, the progeny resulting from selfing developed into plants with a lesser luxuriance of growth and lower disease resistance, and setting fewer seed balls.

The hybrids from a series of ordinary cultivated varieties produced an unusually large mixture of shapes and colors of tubers. No seed was produced when wild types, including *Solanum maglia*, *S. commersonii*, *S. chacoense*, *S. tuberosum*, and *S. edinense*, were used as the male parent in crosses with cultivated varieties. The reciprocal crosses set seed which apparently developed normally, but only in *Maglia* × *Maiprinzessin* was a seed ball containing two seed produced. The Wohltmann variety was effective only as a pollen plant, while two strains isolated from this variety served equally well as male or female parents.

New potato hybrids, SCHRIBAU (Compt. Rend. Acad. Agr. France, 8 (1922), No. 4, pp. 81, 82).—A further note on potato hybrids obtained by Aumiot (E. S. R., 45, p. 432).

Seed potatoes for Connecticut, W. L. SLATE, JR., and B. A. BROWN (Connecticut Storrs Sta. Bul. 107 (1921), pp. 51–56, fig. 1).—Satisfactory seed potatoes have not been produced so far in Connecticut; in trials at the station, seed grown 1, 2, 3, and 4 years in the State produced 79, 55, 65, and 47 per cent, respectively, of the yield of “new” northern-grown seed. The fact that Connecticut growers have no control over the production of seed indicates the desirability of using certified seed, and besides, certified strains averaged 62 bu. of marketable tubers more than uncertified in 1920 and 44 bu. more in 1921. The yields of the Green Mountain and Rural groups have differed but little at the station, while during a period of 6 years, Irish Cobbler has averaged 60 bu. less per acre than Green Mountain. However, the early maturity of Irish Cobbler and the higher market prices for the early crop are advantageous to the small grower without spraying equipment.

Potato maturity trials, 1921 (Jour. Min. Agr. [London], 28 (1922), No. 11, pp. 1044, 1045).—Results of tests at Ormskirk gave indications that in varietal comparisons a negative correlation between high yield and early maturity may be expected. The data suggested that within a variety, neither the place of origin nor the small irregularities in the test plat soil have a material effect on maturity, but both influence yield very considerably.

White Yolo, a new grain sorghum, G. W. HENDRY (Calif. Cult., 58 (1922), No. 8, pp. 205, 208, 209, figs. 3).—White Yolo, a hybrid improved by the California Experiment Station at the Davis Farm, is said to ripen as early as milo and to have slightly outyielded milo in 1920 and 1921. Its chief advantage over other grain sorghums lies in its dwarf stature (4.5 ft.), uniform height, and erect carriage of all heads. The common grain header such as is used for barley and oats may be employed in its harvest.

[Grades for grain sorghums in the head] (Tex. Markets and Warehouse Dept., State's Marketing Bul., 3 (1922), No. 11, p. [1]).—These standards of grades effective January 1, 1922, govern transactions in yellow milo, kafir, feterita, mixed heads, and other grain sorghums.

An annotated list of sugar-cane varieties, F. S. EARLE (Jour. Dept. Agr. Porto Rico, 4 (1920), No. 3, pp. 80).—A list of 1,695 names that have been applied to cane varieties in different parts of the world are given, together with a bibliography listing the principal publications consulted.

Cases are cited where sugar-cane countries growing Otaheite cane under various names, almost exclusively, experienced disaster because of the failure of that variety from attacks of different pests and diseases: Réunion and Mauritius in 1840 to 1850, Brazil in 1860, Java after 1880, Porto Rico in 1872, and, recently, the West Indies, Australia, southern India, Hawaii, Natal, and Argentina. In each case the sugar industry was saved by the substitution of introduced varieties proving more resistant to the prevailing trouble. The author feels that this indicates the need of a better knowledge of the characters of sugar cane, not only of the sucrose content and milling qualities but vigor of growth, tillering power, resistance to diseases and pests, adaptability, and the numerous morphological characters by which alone they can be accurately distinguished.

[**Experimental work with sugar cane in Queensland, 1921**], H. T. EASTERBY (*Queensland Bur. Sugar Expt. Stas. Ann. Rpt.*, 21 (1921), pp. 1-42, 47, 48).—The continuation of work along the same general lines as noted heretofore (E. S. R., 45, p. 41) is reported for the year ended with October, 1921.

In tests at Mackay of the effect of muriate and sulphate of potash on cane juice, the muriate gave results slightly superior to the sulphate on the plant crop. The use of only 100 lbs. of potash per acre accompanied the highest purity and yield of commercial cane sugar, whereas 200 and 300 lb. potash dressings resulted in lower purity and sugar yields than from the unfertilized check. At Bundaberg, Badilla cane planted in 5, 6, and 7 ft. rows averaged in four crops 27.5, 25.6, and 21.2 tons of cane per acre, respectively, with 4.68, 3.8, and 3.55 tons of sugar. Applications of large quantities of lime were unprofitable. In comparisons of different parts of the stalk for planting, the second 3 eyes from the top and the butts, or seventh 3 eyes, gave the highest yields, and were followed by the fourth, third, first or top, fifth and sixth 3 eyes in the order named.

[**Experimental work with tobacco in Canada in 1920**], F. CHARLAN, H. A. FREEMAN, G. C. ROUTT, D. D. DIGGES, and J. E. MONTREUIL (*Canada Expt. Farms, Tobacco Div. Interim Rpt.*, 1921, pp. 4-9, 10-33, figs. 4).—The experiments reported for the year ended March 31, 1921, comprise trials of fertilizers, cultural methods, varieties and hybrids, studies of methods of harvesting the crop and for the control of insects and diseases, breeding work, parthenogenetic experiments, and nicotin studies. See also earlier notes (E. S. R., 43, p. 336; 45, p. 822).

The application of 400 lbs. of sulphate of ammonia, 500 lbs. of acid phosphate, and 200 lbs. of sulphate of potash was held most profitable for White Burley producing 2,410 lbs. of tobacco per acre as compared with 1,400 lbs. from untreated plats, and with a far superior body, color, and general quality. Conclusive indications were not shown in yields, quality, maturity, or color of leaf as to the superiority of drilling over broadcasting fertilizers. Home-mixed fertilizers gave yields about equal to those of artificials and at a cost of about \$20 less per ton. The total yields produced, and the quality of the binders indicated sulphate of ammonia as the best of the nitrogenous fertilizers tested for cigar tobacco, cottonseed meal and linseed meal as next and about equally efficient, and fish meal as the poorest. A high percentage of trash and torn leaves was present on the plats receiving organic nitrogen. Acid phosphate gave better results than basic slag as a source of phosphoric acid.

Glass covered semi-hotbeds proved superior to all other types of beds tested at Harrow, Ont., for the production of early seedlings. A top-dressing of black compost on the beds was found beneficial, less water being required and more plants produced. Seedlings were grown at Farnham, Que., at a cost of \$1.235 per thousand.

Comparisons with seed of Hope Standup Burley, Warne, and Flanagan varieties showed that plants ready for transplanting could be produced from home-grown seed 4 to 8 days earlier than from foreign-grown seed, and they matured earlier, ripened more uniformly, and gave heavier yields, with a higher percentage of bright colored leaves than plants from the foreign seed. It is indicated that seed pods should be fairly brown before harvesting and before the leaves are removed. Fifty-eight seed heads of Resistant Burley, 28 of Broadleaf Burley, and 22 of Warne, respectively, were required to produce a pound of cleaned seed.

[**History of the Porto Rican tobacco industry**], C. COLL Y TOSTE (*Tobacco*, 73 (1921), No. 9, pp. 13-15, 57, 58, figs. 6).—A historical account of the development of the tobacco industry in Porto Rico.

Hibshman strain in first practical field test (*Tobacco*, 73 (1921), No. 5, pp. 7, 30, figs. 4).—Hibshman, a seed leaf tobacco developed by O. Olson from the cross Slaughter×Taylor, outyielded either parent and had fewer suckers than Slaughter. It is described as 7 to 10 days earlier than other seed leaf strains and withstanding dry weather better than its parents and 20 other strains of seed leaf. Hibshman was the highest yielding, and apparently withstood root rot the best, of the seed leaf strains tested at Ephrata, Pa., in 1921.

Perique tobacco, its culture and uses, A. S. BROWN (*Tobacco*, 73 (1922), No. 14, p. 7).—Practical information on harvesting and curing methods used in producing the perique type of tobacco in Louisiana.

The wheat plant, J. PERCIVAL (*London: Duckworth & Co., 1921, pp. X+463, pls 71, figs. 157*).—Part 1 of this monograph gives the results of the author's investigations of the morphology, anatomy, growth, and development of the wheat plant, particularly *Triticum vulgare*. In part 2 are described and discussed the taxonomy, characteristics, origin, and relationships of the wild species of wheat, and the races and varieties of cultivated forms. Chapters are included considering variation, hybridization and wheat hybrids, improvement and breeding of wheat, and the factors influencing yields. A list of varieties with their countries of origin and an extensive bibliography are appended.

Winter wheat in western Nebraska, L. L. ZOOK (*Nebraska Sta. Bul. 179* (1922), pp. 37, figs. 9).—Comparisons were made of different tillage practices with winter wheat grown in rotation of various lengths, and by different methods of preparation under systems of continuous cropping at the North Platte and Scottsbluff, Nebr., Akron, Colo., and Ardmore, S. Dak., Substations. The effects of tillage practices and of the previous crops are considered only for the season immediately preceding the growing of the wheat. The work was in co-operation with the U. S. Department of Agriculture. Studies of seed-bed preparation for winter wheat have been noted earlier (E. S. R., 45, p. 437).

The highest average acre yields of wheat followed summer tillage while the lowest production was secured from continuous cropping. Good yields of wheat were obtained after corn at all stations. At three of the stations less total wheat was produced by summer tilling half the land than by continuously cropping all of the land to wheat. Plowing under rye or peas for green manure failed to increase average yields over those following summer tillage and proved the least profitable of the methods tried.

When the value of the corn crop and the low cost of production were considered, the most profitable yields of wheat were those following corn. Allowing for savings in seed and in seeding and harvesting costs from summer tilling, the average profits from summer tilling and continuous cropping to wheat were about equal. In the average of all tests at all stations, each additional bushel of wheat produced under summer tillage cost an equivalent of 4.9 bu. of corn produced under the corn-wheat rotation.

The average moisture content of the soil in spring was greater after summer tillage than after either corn or wheat, and greater following corn than after wheat. These differences are considered the chief cause of yield variations between the different methods. Kanred was the most promising variety in tests of winter wheats at North Platte and Akron.

[Weeds in Sudan grass], F. F. COLEMAN (*Queensland Agr. Jour.*, 17 (1922), No. 1, p. 19).—The weed and other foreign seeds most frequently occurring in seed of Sudan grass in Queensland are as follows: *Datura stramonium*, *Xanthium spinosum*, *Hibiscus trionum*, *Chenopodium* sp., *Panicum sanguinale*, *Sorghum vulgare*, *Avena fatua*, *Centaurea melitensis*, *Bromus unioloides*, *Melilotus parviflora*, *Sida retusa*, *Polygonum* sp., *Setaria* sp., and *Apium* sp.

HORTICULTURE.

Varietal differences in hardiness, R. B. HARVEY (*Market Growers Jour.*, 30 (1922), No. 7, pp. 14, 16).—This is a contribution from the University of Minnesota, relating to studies wherein the author, by utilizing a chamber in which temperature could be accurately controlled, was able to detect variations in hardiness existing between varieties of a single vegetable species.

In determinations with 14 varieties of tomatoes, the lowest freezing point recorded was 29.4° F. and the highest 30.91°. The difference, 1.51°, is attributed to variations in the thickness of the skin and in the amount of cracking around the stem end, inasmuch as Livingston Globe and Trucker Favorite, two varieties possessing relatively thick skin, were found to be less easily frozen than Earliana, a thin-skinned variety very susceptible to cracking.

Studies with cabbage indicated wide differences in the ability of varieties to harden. Jersey Wakefield, Charleston Wakefield, and Danish Ballhead were found to develop resistance to cold much more rapidly than All Season, Zittauer, and Danish Stonehead, and of all the varieties studied Jersey Wakefield proved to be the hardiest. No significant differences were found in the freezing points of varieties of Chinese cabbage, all proving more susceptible to frost than ordinary cabbage and hardening with greater difficulty.

A wide range of hardiness was recorded in a study of 50-odd varieties of lettuce, Hicks Hardy Winter Cos proving the most resistant.

Of the various factors believed to contribute to frost resistance, differences in sugar content, the development of a waxy covering on the leaves and fruits, and increasing thickness of the epidermis in response to lowering temperature are considered important. Furthermore, it is deemed probable that the proteins making up the living contents of the cell undergo changes whereby the plant becomes less sensitive to alterations in temperature. It is believed that the methods of technique used in the study will be of great assistance in breeding projects in which hardiness is a desired objective, especially since small differences too insignificant to be detected in field tests can be determined in the temperature controlled chamber.

The principles of vegetable gardening, L. H. BAILEY (*New York: Macmillan Co.*, 1921, 18. ed., [rev.], pp. XIII+490, figs. 252).—This is a completely revised and reset edition.

Vegetable gardening in Oregon, A. G. B. BOUQUET (*Oregon Sta. Circ.* 23 (1922), pp. 3-43, figs. 12).—In this general discussion of vegetable production in Oregon, designed primarily for the assistance of the practical grower, data are presented relative to the particular requirements of all the important vegetable crops grown in the State. Emphasis is placed upon the importance of high-grade seed, using a table showing the comparative yield of six strains of broccoli as a means of illustration. Among general information presented are

data relative to community production, production for canneries and dehydrators, greenhouse culture, use of frames, soil sterilization, soils, fertilizers, irrigation, and cold storage.

[Variety tests at Wisley] (*Jour. Roy. Hort. Soc.*, 47 (1922), No. 1, pp. 43-89).—Detailed descriptive data are given for many varieties of raspberries, strawberries, garden peas, and dahlias tested during the period 1919-1921.

Growing head lettuce in Idaho, C. C. VINCENT (*Idaho Sta. Circ.* 21 (1922), pp. 11, figs. 3).—A circular of information relating to the production of head lettuce in Idaho, including data relative to the importance of the industry, climate, soils, fertilizers, seed, cultural practices, harvesting and yields.

Some tests of melon varieties, H. W. SCHNECK (*Market Growers Jour.*, 30 (1922), No. 7, pp. 6, 7, figs. 2).—Bender Surprise, a variety said to comprise over 90 per cent of the commercial melon crop of New York State at the present time, proved to be the highest yielding among 12 muskmelons included in a one year test at Cornell University. Angelo, a new variety from Idaho, indicated promise on account of extreme earliness in maturity.

[Tomato breeding at the Pennsylvania Experiment Station], C. E. MYERS (*Penn. Farmer*, 85 (1922), Nos. 12, pp. 3, 25, fig. 1; 13, pp. 2, 25, figs. 2).—Following a brief historical review of the development of the cultivated tomato, the author discusses tomato breeding in general and sets forth certain laws of inheritance which have been established by the work of various plant breeders.

In selection studies with the Earliana, a type was isolated which on account of improved symmetry, solid flesh, less acidity, less tendency to crack, and increased productivity has been maintained under the name Penn State Earliana. Although several years were spent in establishing this new strain, the author points out that little improvement was obtained after the original selection. A second tomato, recently christened Nittany, was selected from the F_2 generation of a cross between Enormous and Yellow Pear, the first named being the ovule parent. Of the 727 F_2 plants, 555 bore red and 172 yellow fruits, a close agreement with the theoretical color segregation according to Mendel's law. In 1921 the Nittany variety produced over 15 tons of marketable fruits per acre and was exceptionally free from cracking, proving superior to all other varieties included in the test.

The winter study of fruit trees, E. A. BUNYARD (*Jour. Roy. Hort. Soc.*, 47 (1922), No. 1, pp. 18-25, pls. 3).—A paper pointing out that varieties of deciduous fruits, including the apple, pear, cherry, and plum, may be readily distinguished during the dormant period by careful observations of various growth characters, for example, form of the mature tree, length of internodes, presence or absence of pubescence, shape and number of lenticels, and shape, size, and angle of insertion of the buds.

Breeding fruits, U. P. HEDRICK (*Penn. State Hort. Assoc. Proc.*, 62 (1921), pp. 48-57).—In this address, the author presents a broad review of the fruit-breeding activities at the New York State Experiment Station.

It is pointed out that the studies have shown that certain characters in plants are often correlated with others, and that this knowledge has in many instances enabled the station plant breeders to pass judgment on seedlings without waiting for their fruiting. In many instances relatively obscure varieties have proved to be consistently valuable as parents, while others far better known have shown no merit. It is emphasized that Geneva experiments in bud selection have so far shown no evidence to indicate that fruits can be improved in this way.

Transplanting fruit trees, A. PETIT (*Jour. Soc. Natl. Hort. France*, 4. ser., 23 (1922), Feb., pp. 84-87).—In a transplanting test with Passe Crassane pears on quince and Reinette de Canada apples on Paradise roots, half of each lot

were severely root pruned by shortening the main stock and removing all fibrous roots, and half were planted without any root treatment to serve as a control. No pruning was done to the tops of any of the trees. At the end of two years trees of both treatments were cut off at the ground and weighed, with the following results: Unpruned pears averaged 8.289 kg., pruned pears 7.43, unpruned apples 3.171, and pruned apples 2.559 kg. The author points out that the favorable results of no pruning may have been partly due to the fact that the roots were exposed only for a very short time to the air, thus causing little injury to the small roots.

Collected leaflets on fruit: Its cultivation, marketing, and preservation (*London: Min. Agr. and Fisheries, 1921, pp. 155, pls. 19, figs. 34*).—This volume, composed of miscellaneous leaflets on various subjects relating to fruit production and fruit preserving, is designed for the purpose of presenting the results of recent horticultural research to the practical grower.

Pollination in orchards.—V, Summary of apple pollination investigations, A. N. RAWES (*Jour. Roy. Hort. Soc., 47 (1922), No. 1, pp. 8-14, fig. 1*).—This paper, fifth in a series from the Wisley laboratory upon the general subject (*E. S. R., 46, p. 39*), treats in particular of results obtained in a greenhouse study in which approximately 50 apple varieties, comprising practically all important English sorts, were tested for self-fruitfulness, in order to verify results obtained by Chittenden in previously reported outdoor studies (*E. S. R., 31, p. 337*).

Many varieties that set no fruit under bags in the open developed a few fruits indoors when pollinated by hand. Other varieties which set only a few fruits outdoors developed a fair crop in the greenhouse, and in every instance those varieties setting fruit under bags outdoors produced fruit in the greenhouse. Of the 50 varieties tested in the greenhouse, only 8 proved self-fruitful, 39 were partly self-fruitful, and 3 failed to set any fruit at all. Records show that even with self-fruitful varieties increased production was obtained as a result of cross-pollination. Studies involving the use of various varieties as pollen parents revealed no instances of pollen preference, and no case of intersterility was discovered. In the belief that effective cross-pollination is largely dependent upon compatibility in periods of bloom, the date of full bloom and the average duration of the blooming period were recorded for many varieties and are presented in graphical form for 10 of the more prominent. It is recommended that orchards lacking in proper varieties for effective pollination be improved by top-working with scions of compatible sorts, and it is urged that in the establishment of new orchards proper attention be paid to intermixing of varieties.

Pollination in orchards.—VI, Pollen-carrying agents, A. N. RAWES and G. F. WILSON (*Jour. Roy. Hort. Soc., 47 (1922), No. 1, pp. 15-17*).—This contribution, in continuation of the general series noted above, briefly reports upon experiments relative to the function of wind and insects in fruit pollination.

The insignificant part played by wind was indicated by the fact that glycerin coated glass plates suspended for three days in close proximity to full blown apple, pear, and plum trees failed in some cases to collect any pollen grains. In the few successful instances it was evident that insects had transported the pollen.

Careful records upon the species of insects visiting apple blooms showed that hive bees were active only on bright, sunny days, while, on the contrary, other insects kept busy during dull weather. This was shown in 1920 when an excellent crop of fruit was obtained following a blossoming season during which no hive bees had been observed at work. The bumblebee was found to be a very important pollinator, keeping active in all kinds of weather, a few indi-

viduals having been observed at work during a snow squall. Among species of bumblebees, *Bombus lapidarius*, *B. terrestris*, and *B. lucorum* were frequently recorded and more rarely *B. muscorum* and *B. helveranus*. Bees belonging to *Andrena* and allied genera were numerous and active. Hover flies were next to bees in frequency, and midges and small two-winged flies were often recorded. In addition to the above noted, which were classified by the authors as normal visitors, a long list of miscellaneous insects were observed which apparently played some part in pollination. It is concluded from the study that cross-pollination may be safely left to wild insects.

Productive and unproductive types of apple trees: Studies in orchard management, IV, K. SAX and J. W. GOWEN (*Jour. Heredity*, 12 (1921), No. 7, pp. 191-300, pl. 1, figs. 3).—This paper, continuing a series devoted to orchard management investigations conducted by the Maine Experiment Station (E. S. R., 45, p. 639), presents the results of a study of the relation of tree type to productivity in the Ben Davis apple.

Among 881 trees representing many different forms, two contrasting types were distinguished as characteristic of producing and nonproducing capacities. The productive type was large, vigorous, and open headed, with large and often drooping branches possessing many laterals well supplied with fruit spurs. The unproductive type was small and upright growing, with slender branches possessing relatively few spurs. Biometrical studies, reported in detail in the paper, indicated a high correlation between yield and the different tree types.

Soil heterogeneity, variability in root stocks, and bud variation are discussed in the light of possible causes of differences in productivity. In a study of the distribution of the productive and unproductive types, a marked tendency was noted for the grouping of either type in definite areas coinciding with variations in soil fertility, thus indicating that soil heterogeneity is an important factor in relation to yield. Localized differences in yield were attributed to variations in the root stocks used in the orchard. This hypothesis is supported by records taken in a seedling orchard set in 1911 in which trunk circumferences were found to vary from 2 to 18 cm., and also by data obtained in another orchard in which trunk circumferences were found to be much more uniform in trees worked on asexually propagated Tolman Sweet roots than in the case of those trees worked on seedling French crabs. In discussing the third possible cause, that of bud variation, the authors review the results of various experimenters and conclude that there is no critical evidence to support the hypothesis of variations in yield due to this cause. It is suggested that the use of clonal varieties of root stocks would lead not only to more uniformity but also to increased production.

A tribute to the York Imperial apple, S. W. FLETCHER (*Penn. State Hort. Assoc. Proc.*, 62 (1921), pp. 19, 20, pl. 1).—In this brief eulogy on the York Imperial apple, delivered August 8, 1920, at the dedication of a memorial to this variety erected near York, Pa., the author emphasizes the importance of this fruit to the horticultural industry of the Eastern States.

Stock and scion studies, G. RIVIÈRE and G. PICHARD (*Jour. Soc. Natl. Hort. France*, 4. ser., 23 (1922), Feb., pp. 96, 97).—Observations on the date of maturing of fruits of the Arthur Chevreau pear grafted on Williams Duchesse and Doyenné du Comice, themselves budded on other stocks, showed that the two stocks, notwithstanding the fact that they themselves differed sharply in time of ripening their fruits, had no effect on the time of maturity of the fruit of the scions. The fruit on Williams Duchesse matured on January 18, on Doyenné du Comice on January 20, and on the usual stocks on January 20.

The "peach-almond" hybrid, L. COATES (*Jour. Heredity*, 12 (1921), No. 7, pp. 328, 329, figs. 2).—Accompanying illustrations of the tree and fruit is a brief

account relative to the history, botany, and distribution in California of this hybrid form. The fruits are described as insipid and of no economic value, although the tree is deemed of use as a stock for peaches, almonds, and most varieties of plums.

Raspberry growing in Massachusetts, S. L. DAVENPORT (*Mass. Dept. Agr., Dept. Bul.* 25 (1922), pp. 15, pls. 3).—This circular contains information relating to the status of the raspberry growing industry in Massachusetts, with notes on varieties, cultural practices, methods of training, etc.

A preliminary note on the increase of grape yield, S. H. PRAYAG (*Agr. Jour. India*, 17 (1922), No. 1, pp. 41-50, pls. 2).—This is a report of miscellaneous experiments conducted at the Ganeshkhind Botanical Garden in an attempt to discover practices which would induce greater productivity in the grape.

The native home of the cherimoya, W. POPENOE (*Jour. Heredity*, 12 (1921), No. 7, pp. 330-336, figs. 3).—An account of the author's explorations in southern Ecuador in search of the wild cherimoya, which was found occurring in such profusion and under such natural circumstances as to lead to the conclusion that this territory is the native home of the fruit. The size and quality of the wild fruits was found to compare very favorably with those of cultivated trees, thus indicating little improvement due to years of cultivation.

The classification of garden irises, W. R. DYKES ET AL. (*Jour. Roy. Hort. Soc.*, 47 (1922), No. 1, pp. 2-7).—This paper presents a classification based primarily upon the color of the blooms but providing in each color class for groups arranged according to the time of blooming and the height of the flowering stalk. The origin of various species and so-called species is discussed.

Notes on the origin of the moss rose, C. C. HURST and M. S. G. BREEZE (*Jour. Roy. Hort. Soc.*, 47 (1922), No. 1, pp. 26-42).—A technical paper presenting the results of researches into the history and botany of the moss rose, with information relative to parent species and direct descendants. A bibliography of numerous citations to the literature is included.

FORESTRY.

The national parks portfolio, R. S. YARD (*Washington: Dept. Int.*, 1921, 3. ed., enl., pp. 266, figs. 307).—An illustrated handbook prepared for the purpose of acquainting the public with the scenic beauty of the national parks.

The forests of Washington County, F. W. BESLEY (*Baltimore: Md. State Bd. Forestry*, 1922, pp. 28, pls. 4).—Information is presented relative to the character and composition of the forests of Washington County, Md., their distribution, the more important species, the yields of lumber and wood products, and silvicultural and fire prevention operations. Accompanying the report is an enlarged and detailed forest map showing the distribution of the different types of forests.

The forests of Frederick County, F. W. BESLEY (*Baltimore: Md. State Bd. Forestry*, 1922, pp. 32, pls. 4).—Information similar to the above is presented for Frederick County, Md.

The management of the Harvard Forest, 1909-1919, R. T. FISHER (*Harvard Forest Bul.* 1 (1921), pp. 27, pls. 22, fig. 1).—In this illustrated report on the Harvard Forest at Petersham, Mass., maintained for three definite purposes, (1) to serve as a model forest for the demonstration of ideal forest practices, (2) as an experiment station for research in forestry, and (3) as a field laboratory for students, data are presented relative to the location of the forest, the history and composition of its forest flora, and silvicultural methods in operation.

[Report of the] division of lands and forests (*N. Y. State Conserv. Comm., Ann. Rpt., 11 (1921), pp. 97-140, figs. 22*).—A report of the activities of the division of lands and forests during the calendar year 1921, featuring recreational provisions, reforestation, fire protection, and white pine blister rust control. Lists are included of coniferous and broadleaf species which are deemed to be best adapted for planting in New York, with the soil preference for each species indicated.

Reports of the forestry commission for the years ended June 30, 1920, and June 30, 1921, R. DALRYMPLE-HAY ET AL. (*N. S. Wales Forestry Comm. Rpts., 1920, pp. 34, pls. 9; 1921, pp. 16, pls. 2*).—These reports covering the two years ended June 30, 1921, contain the usual information (*E. S. R., 42, p. 839*) relative to administration, silvicultural operations, alterations in area, fire protection, revenues, expenditures, etc.

Tree planting on the prairies of Manitoba, Saskatchewan, and Alberta, N. M. ROSS (*Canada Dept. Int., Forestry Branch Bul. 1 (1920), 7. ed., rev., pp. 60, figs. 40*).—This revision of a previously noted publication (*E. S. R., 25, p. 346*) is in a similar manner devoted to supplying the prairie settlers with information relative to the selection of suitable species of forest trees and their proper utilization.

The propagation of trees from seed, C. E. LEGAT (*Union So. Africa, Dept. Agr. Jour., 4 (1922), No. 2, pp. 161-172, figs. 3*).—Instructions are presented for the propagation of forest tree species in nurseries, since on account of the heat and drought often obtaining in the Transvaal during the dry season only a very few species can be propagated by sowing directly in the open. The more desirable species, including *Eucalyptus*, cedars, oaks, etc., must be sown in boxes and transplanted into the open ground during favorable weather. It is recommended that seeds be sown in flat tin boxes with perforated bottoms so that the plant, instead of developing a long taproot, will form a branching root system capable of sustaining the tree when it is planted in the open.

Broad-leaved evergreen shrubs for the South, F. L. MULFORD (*Amer. Forestry, 28 (1922), No. 338, pp. 99-104, figs. 9*).—An illustrated paper describing several species of evergreen shrubs which are deemed of value for planting in the South.

The cascara tree in British Columbia, J. DAVIDSON (*Canada Dept. Int., Forestry Branch Circ. 13 (1922), pp. 11, figs. 8*).—This circular, pointing out the distinguishing characters of the cascara tree (*Rhamnus purshiana*) and discussing its distribution in British Columbia, is prepared for the purpose of acquainting laymen with the tree and directing attention to the necessity of conserving the supply.

Notes on woods, S. J. RECORD (*Science, n. ser., 55 (1922), No. 1419, pp. 266-269*).—A brief article dealing for the most part with the identity of the species supplying various commercial woods, including West Indian boxwoods, Brazilian tulip wood, coffee wood, rosewood, cocobolo, redwood and satiné, and kakatara-balli.

Trade names for Indian timbers (*Indian Forester, 48 (1922), No. 3, pp. 135-141*).—This is a list of various Indian woods arranged according to their botanical classification with the common trade name placed in apposition.

DISEASES OF PLANTS.

Compendium of nonparasitic plant diseases, P. GRAEBNER (*Lehrbuch der Nichtparasitären Pflanzenkrankheiten. Berlin: Paul Parey, 1920, pp. VII+333, figs. 245*).—The six main divisions of this work (subdivided to make up 14 chapters) deal with diseases due to unfavorable soil conditions, air moisture

and air movements, warmth and light, wounds, injurious gaseous or liquid bodies, and enzymatic diseases.

Plant diseases [in Ontario], G. C. CREELMAN (*Ontario Agr. Col. and Expt. Farm Ann. Rpt.*, 45 (1919), pp. 36-41).—In this portion of the president's report it is stated that the weather during the season greatly favored such diseases as peach leaf curl and stone fruit brown rot. The former was especially destructive, defoliating a large number of trees and in many cases ruining the crop. The effects of spraying were very marked. Early and thorough applications of lime sulphur (dormant wood strength) resulted in very little loss, but trees sprayed late or not at all were almost defoliated. Success depends upon early and thorough spraying. Since continued wet weather in early spring frequently prevents spraying at the proper time, fall spraying has been recommended and where tried has given satisfactory results.

Currant-leaf spot or anthracnose (*Pseudopeziza ribis*) was very prevalent in the Niagara district. Experimentation indicated shows that this disease can be controlled by spraying with Bordeaux mixture. European currant rust (*Cronartium ribicolum*) was again very prevalent throughout the Niagara district, where it appears to be well established.

Diseases named as new for this section include eggplant wilt, stem rot of tomato, and rust of statice. Eggplant wilt (*Nectria ipomoeae*) was found in many sections of the Province during the summer, considerable loss being caused in the counties of Essex, Kent, Lambton, Wentworth, and Welland. The disease is most severe in fields in which eggplant has been grown for a number of years in succession. The fungus overwinters in the soil and may persist for three or four years in the absence of the host.

Tomato-stem rot (*Botrytis* sp.) developed in the college greenhouse during the winter and in some cases finally killed as much as 90 per cent of the plants. Since infection takes place under only very humid conditions, thorough ventilation of the forcing houses is considered to be the best way of preventing loss from this disease.

Statice rust (*Uromyces limonium*) was very destructive in some gardens, the foliage in some cases being completely destroyed.

The investigational work reported includes cooperative experiments in weed eradication, potato-disease investigations in cooperation with agricultural representatives, plat experiments with potato diseases, spraying experiments in the control of celery late blight, experiments testing the spray method of applying concentrated formaldehyde solution for the control of oat smut, an investigation of the causes of tomato winter blight or streak and means of control, studies on the life history of the fungus causing snapdragon rust, experiments in the control of bean-pod spot or anthracnose, experiments in the control of Rhizoctonia or black scurf of potatoes, an investigation regarding the production and germination of twitch grass seed, and a plant disease survey of the truck-growing regions of Ontario, regarding which a few details are given.

Report of the Government botanist for the period April 1 to December 31, 1920, J. D. SNOWDEN (*Uganda Dept. Agr. Ann. Rpt.* 1920, pp. 43-46).—Regarding coffee diseases, it is stated that *Hemileia vastatrix* has been very prevalent during the year and in many cases followed by die-back, *Colletotrichum coffeanum*, these two fungi being responsible for the greater part of the damage done to coffee in Uganda. It appears probable that the various Colletotrichums prevalent on coffee, cacao, tea, and various fruit trees are closely related to each other and possibly varieties of the same species. A Glomerella was found in association with *C. coffeanum* on dead coffee twigs in one locality. Of the diseases of Hevea rubber, those of the bark and cortex appeared to be on the increase, black thread and brown bast both being promi-

nent. The causative fungi of these diseases in Uganda have not been determined, though black thread is usually considered to be due to a *Phytophthora*. A few cases of die-back, *Botryodiplodia theobromae*, have been reported.

Cacao die-back (*B. theobromae*) has been somewhat prevalent. Pod rot (*Phytophthora faberi* and *Colletotrichum* sp.) is fairly common, as is also hardening of pods due to *C. incarnatum*. A twig die-back is caused by *C. theobromicola*.

Tea leaves are attacked by several diseases, the most important being *C. camelliae* (said to be a conidial stage of *Glomerella cingulata*), attacking old and young leaves and seed vessels. A *Pestalozzia* is associated with *Colletotrichum*. *Cephaleuros mycoidea* causes some damage.

Of fruit tree diseases, one causing a fruit rot and twig die-back of the avocado has been investigated and determined as *G. cingulata* in both the conidial and the perithecial stage. *Colletotrichum gloeosporioides* attacks citrus leaves and twigs. *Gloeosporium musarum* attacks banana fruit. Other fungi reported include *Cephaleuros mycoidea* on leaves of avocado and guava, *Puccinia pruni* on peach leaves, and *Sphaerostilbe repens* on mango roots.

Of cotton diseases, the most important is *Glomerella gossypii* with its conidial stage, *Colletotrichum gossypii*. *Ramularia areola* has been somewhat prevalent on the leaves, being sometimes accompanied by a *Macrosporium*. A *Fusarium* appears to be saprophytic on diseased material. A *Botryodiplodia* causes a stem die-back. Cotton diseases, previously reported, include *Cercospora* *gossypii* and *Uredo gossypii*.

Minor crop diseases include *Leptosphaeria sacchari*, still prevalent on sugar cane leaves but showing little effect on the growth. *Puccinia triticea* has caused much damage to wheat on the Kampala plantation, this being the first time this disease has been recorded in Uganda. It was accompanied by *Helminthosporium sorokinianum*, which is also reported in this region for the first time. Rice was attacked by several fungi, notably *Helminthosporium* sp. and *Leptosphaeria* sp. The only maize disease reported is *P. sorghi*. Leaves of *Voandzeia subterranea* were attacked by a *Cercospora*, probably an undescribed species. Other fungi occasionally attacking legumes in Uganda are *Aecidium vignae*, *A. glycines*, *Ascochyta phaseolorum*, *Cercospora personata*, *Erysiphe polygoni*, *Meliola bicornis*, and *Uromyces appendiculatus*. Leaves of cassava (*Manihot utilisima* and *M. palmata*) are attacked by *C. henningsii*. Leaves of Ceara rubber (*M. glaziovii*) are attacked by *C. cearae*. Potato leaves have been attacked by *Alternaria solani*. Native tobacco is attacked by *C. raciborskii*, causing discolored areas on the leaves.

Host index of diseases of economic plants in the Philippines, O. A. REINKING (*Philippine Agr.*, 8 (1919), No. 1-2, pp. 38-54).—This list is on much the same plan as that previously noted (*E. S. R.*, 41, p. 841).

In the brief introduction it is claimed that in certain articles on tropical phytopathology, instanced by that of Westerdijk (*E. S. R.*, 34, p. 48), the number and destructiveness of diseases of tropical plants have been greatly underestimated. All of the groups of disease fungi which are present in the temperate regions are represented in the Tropics, some extremely destructive diseases being produced by members of each group. It is positively stated that plant diseases are fully as numerous and destructive in the Tropics as they are in the United States or in other countries in the Temperate Zone. This is evidenced by the large number of disease organisms here listed as attacking many plants.

Dusts and dusting for insect and fungus control, I, II, G. E. SANDERS and A. KELSALL (*Sci. Agr.*, 1 (1922), No. 1, pp. 14-18, figs. 2; 2 (1921), No. 1, pp. 7-14).—The two articles constituting the present contribution, crediting certain

tabular detail to Whetzel (E. S. R., 46, p. 448), deal, respectively, with the existing status of dusting and dusts containing copper and arsenic.

The first article compares dusts and sprays as regards effectiveness and costs, concluding that under orchard conditions dusts have some definite advantages over sprays, being (at least potentially) as cheap and as efficient in the control of scab and of biting insects but inferior to sprays in the control of sucking insects. The second article concludes that dusts containing copper and arsenic are effective in controlling biting insects and black spot under the conditions existing in Nova Scotia. While some commercial Bordeaux powders may be as effective as the copper-arsenic dust here described, they will probably continue to be more expensive. Work done on potatoes with these dusts is to be reported later. It appears that the copper-arsenic dust or some other dust containing copper and arsenic should come to play an important part in plant pest suppression.

Fungicidal dusts for the control of smut, G. P. DARNELL-SMITH (*Agr. Gaz. N. S. Wales*, 32 (1921), No. 11, pp. 796-798).—A review of certain recent contributions and discussions emphasizes the alleged fungicidal action of copper carbonate, this being the supposed ultimate form of the deposit upon leaves sprayed with Bordeaux mixture.

The effect of citric acid on the germination of the teliospores of *Puccinia graminis tritici*, A. F. THIEL and F. WEISS (*Phytopathology*, 10 (1920), No. 10, pp. 448-452, fig. 1).—Some results are given of cooperative investigations carried on between the Minnesota Experiment Station and the Bureau of Plant Industry, U. S. D. A., on the germination of rust spores, the investigation in this case being confined to modifications of the permeability of the spore wall. Ordinarily the teliospores were found not to germinate until after a considerable period of rest, but when treated with 1 per cent citric acid germination was obtained in a much shorter time than normally. The best germination was secured where the spores were exposed to citric acid for 15 minutes.

The effect of citric acid and various salts of the acid is still being investigated.

Corn root rot (*Kentucky Sta. Rpt. 1920*, pt. 1, p. 28).—Studies are reported of 39 varieties of corn from 27 localities in the United States in which it was found that seed and ear infection with *Fusarium moniliforme* is probably universal. It is claimed that partial control might be obtained by using for seed purposes only ears the seedlings of which show a high degree of resistance to the rot when grown in sand in a warm room. Plants which ripen their ears at the usual time but remain green for a considerable time following ripening have been found to produce more resistant seedlings than those which die previously to or at the time of ripening of the ears.

Rhizopus infection of corn on the germinator, J. F. ADAMS and A. M. RUSSELL (*Phytopathology*, 10 (1920), No. 12, pp. 535-543, figs. 6).—The authors report serious injury to corn seedlings in the germinator due to the development of *Rhizopus nigricans*. A study was made to determine the manner in which the embryonic plant was attacked. The rupture of the pericarp seems to furnish conditions favorable for the infestation of the scutellum, which interferes with the normal function in the nutrition of the young plant. The organism in question is said to be so ubiquitous that efforts should be made to exclude it from the germinator if an index to normal germination is sought.

Mycological research on cotton, [M. A. BAILEY] (*Egypt Min. Agr., Cotton Research Bd., Ann. Rpt. 1* (1920), pp. 42-45).—It is claimed as beyond reasonable doubt that cotton soreshin is due locally to a Rhizoctonia. This form, while at present unsatisfactory as to classification, is considered probably

identical with *Corticium vagum*. A detailed account of the disease is to be published.

A boll rot showed *Rhizopus nigricans*, which was supposed to cause the trouble and to be carried by the cottonseed bug *Oxyarenus hyalinipennis* and the bollworms *Earias insulana* and *Gelechia gossypiella*. This disease also is to be dealt with in a special publication. Leaf spot appearing late on weak plants is attributed to *Mycosphaerella gossypina*.

Rhizoctonia causing cotton soreshin and root rot in India has been found to cause also in Egypt a root rot and wilting of *Lubia* and *Phaseolus*, but the fungus from these plants has not been known previously to infect cotton seedlings in Egypt. However, the same fungus has been found in the roots of a wilted cotton plant at El Giza. It is thought that cotton wilt in Egypt may be caused by more than one soil organism. Observations on the percentage of injury due to wilt are considered inconclusive.

The presence of perennial mycelium in *Peronospora schleideni*, P. A. MURPHY (*Nature* [London], 108 (1921), No. 2714, p. 304).—It has now been proved that mycelium of *P. schleideni*, the onion mildew fungus, is capable of perennial existence in onion bulbs, shoots produced therefrom being infected from the start.

For a time in early spring, usually in April, mildew is found only on onions, the bulbs and leaves of which are permeated with mycelium. The plants appear to act as important centers of infection. Though no harm becomes apparent for a long time, the leaf tips finally turn yellow and droop. Under favorable weather conditions mildew then breaks out, at first just below the withered portions of the older leaves, then on all leaves except the youngest. A nice balance appears to exist between host and parasite, the internal mycelium breaking out into conidiophores only at a certain stage of maturity, and the host tissue persisting for some time thereafter.

Nonseptate mycelium, apparently that of *P. schleideni*, has been found in the bulbs of the common onion, in those of the potato or underground onion, and of the shallot. In case of the common onion and shallot this mycelium has been definitely connected with the mildew fungus. It has also been proved that the mycelium survives when infected bulbs are left in the soil during the winter. This is possibly an important point in the case of Tripoli onions, which are sown in the autumn.

Infected bulbs showed mycelium plainly when they were examined in spring, autumn, and winter.

The effect of this fungus on the keeping qualities of infected bulbs requires further study, as do other points in this strangely overlooked phase in the life history of this common and destructive parasite.

Diseases [and pests] of the potato, B. T. DICKSON (*Sci. Agr.*, 2 (1921), Nos. 2, pp. 55–57, figs. 2; 3, pp. 93–96, figs. 3).—It appears that losses in Canada from potato troubles amount to millions of dollars annually. A list here given includes hopperburn (or tipburn), mosaic and mosaic dwarf, leaf roll, powdery scab (*Spongospora subterranea*), blackleg (*Bacillus atrosepticus*), black wart or potato canker (*Chrysophlyctis endobiotica*), leak (*Pythium debaryanum*), late blight (*Phytophthora infestans*), wilt and stem rot (*Sclerotinia libertiana*), dry stem rot and black scurf (*Corticium vagum solani*), early blight (*Alternaria solani*), wilt (*Fusarium oxysporum*), common scab (*Actinomyces scabies*), skin spot (*Oospora pustulans*), silver scurf (*Spondylocladium atrovirens*), tuber dry rot (*Fusarium* spp.), net necrosis (*Fusarium* spp.), blackheart, frost necrosis, spindling sprout, hollow heart, and arsenical injury.

Discussion of diseases in which insects supposedly play an important rôle includes hopperburn, mosaic and mosaic dwarf, and leaf roll.

Potato [disease] experiments, H. M. NICHOLLS (*Tasmania Agr. and Stock Dept. Rpt. 1920-21, pp. 13, 14*).—This report deals with the second stage of the tests previously noted (E. S. R., 45, p. 846), in which seed potatoes were kept for four hours at 125° F. with the object of killing disease organisms, the sprays (principally Bordeaux mixture 4:4:40) being used twice to prevent infection by wind-borne spores. The acre plat of Brownell potatoes yielded 45 bags, of which all were fit for market or seed except 2.75 bags.

The potatoes from this test plat were planted the next year without further treatment to test for any carrying over of the effects of heating to a second generation. It was noted that seed of the same variety planted in the same field and cultivated in the same manner showed an inferiority which was clearly distinguishable, even at a distance. On digging, a considerable superiority as regards yield was found for the descendants of the potatoes which had been subjected to heating, the increase being 1.434 tons per acre over the yield from the untreated seed, which gave only 3.585 tons per acre.

The author is of the opinion that this process supplies an easy and inexpensive means of increasing substantially the potato yield in Tasmania. Irish blight is controlled by maintaining a temperature of 104° for four hours.

Mosaic disease of potatoes, A. D. COTTON (*Jour. Min. Agr. [London], 28 (1921), No. 4, pp. 335-340*).—Mosaic of potato is thought to have existed for many years in Great Britain. It now occurs in all portions, though in varying degree of intensity. The typical disease is said to be more conspicuous toward the North, but more serious in the warmer parts of the country, though markedly decreased in violence (sometimes to the vanishing point) by the heat and drought of some sections. In certain parts of England it persistently attacks seedlings in its most intense form, at times practically killing out first year plants.

Marked variation is noted in the percentage of the infection and in the intensity of the attack when varieties are considered. Several of these are mentioned as very susceptible.

Infected plants do not recover but carry the disease in the tubers. Insects carry the disease to healthy plants, and the following season shows an increase in its prevalence.

Care should be taken not to use infected or suspected tubers for seed. Rogueing is not considered profitable.

A suspected mosaic disease of sweet clover, H. R. McLARTY (*Phytopathology, 10 (1920), No. 11, pp. 501-503, fig. 1*).—A brief description is given of a mosaic condition of sweet clover plants in which the leaves of affected plants had a mottled appearance, were distorted and curled, and the plants somewhat dwarfed and unhealthy in appearance.

Tobacco root rot, angular leaf spot, and wildfire (*Kentucky Sta. Rpt. 1920, pt. 1, p. 26*).—It is reported that 16 out of 17 selections of Burley tobacco when tested in a badly diseased field proved very resistant to the root rot caused by *Thielavia basicola*.

Cultural and field studies of the leaf spot diseases prevalent in the tobacco-growing sections of Kentucky are said to have shown that the diseases are identical with angular leaf spot and wildfire, and that these diseases were probably present in the tobacco-growing areas previous to 1920.

A fourth Phytophthora disease of tomato, D. REDDICK (*Phytopathology, 10 (1920), No. 12, pp. 528-534*).—The author gives an account of a disease of tomatoes observed on a crop grown in the vegetable houses at Cornell University. The symptoms included a typical damping-off of seedlings, a girdling of stems of all ages and at any point, a blight of foliage, a rapid rot of the fruit, and

the gradual death of foliage from the base, eventually resulting in the death of the plant.

The cause of the disease has been determined as a species of *Phytophthora*, and the organism is compared in its characteristics with other well-known species.

Sclerotinia wilt of greenhouse tomatoes, B. T. DICKSON (*Phytopathology*, 10 (1920), No. 11, pp. 500, 501, fig. 1).—The author describes a badly wilted condition of tomato plants in commercial greenhouses in Quebec, the plants being attacked by the fungus *S. libertiana*. The bed in which the tomatoes were grown had previously been planted with lettuce which suffered from a severe attack of lettuce drop, and this may have been the source from which the infection was obtained.

Stem-end rot of greenhouse tomatoes, B. T. DICKSON (*Phytopathology*, 10 (1920), No. 11, pp. 498-500, fig. 1).—A description is given of a stem-end rot of tomatoes found in a greenhouse in Quebec, the trouble being due to *Botrytis* sp. In addition to attacking the fruit, the fungus was found to occur on the calyx, fruit stalk, and stems of the plants.

Tests of the wilt resistance of different tomato varieties, C. W. EDGERTON and C. C. MORELAND (*Louisiana Stas. Bul.* 184 (1921), pp. 3-24, figs. 8).—The results are given of a three years' test of commercial varieties and various wilt-resistant selections of tomatoes.

It was found that the wilt disease attacks all varieties, but it kills susceptible plants much quicker than it does the resistant ones. Most commercial varieties of tomatoes were found very susceptible to the disease, although there were some exceptions. The wilt percentage during the middle of the picking season is said to show the comparative wilt resistance of the different varieties. A number of so-called resistant varieties developed at different places in the Southern and Middle States were tested, and varieties which had been developed by the Louisiana Stations were found to be satisfactory for Louisiana conditions, both in resistance to the wilt and in their yielding ability. Two varieties sent out by the U. S. Department of Agriculture, Norton and Marvel, were found satisfactory as to resistance to wilt and in yield.

Apple black rot (*Sphaeropsis malorum*) in Oregon, C. R. STILLINGER (*Phytopathology*, 10 (1920), No. 10, pp. 453-458).—The author reports the occurrence of the black rot due to *S. malorum* in Oregon, as well as its probable presence in Washington and California. It is stated that the disease does not appear to be of great economic importance so far as observed.

Downy mildew, H. L. MANUEL (*Agr. Gaz. N. S. Wales*, 32 (1921), No. 10, pp. 745-747, fig. 1).—Grape downy mildew, said to have originated in America and to have reached Australia by way of Europe on grafted cuttings, appeared in Victoria early in 1917 in a mild outbreak, spreading rapidly early in the following season and affecting the clusters as well as the foliage. Optimism caused neglect of spraying, and owing to the occurrence of favorable conditions the fungus spread like wildfire in all directions, reaching practically every vine in the State and causing large losses. In 1920 it appeared in Queensland and late in the season in South Australia.

Signaling *Peronospora* outbreaks, 1920, P. VOGLINO (*Nuovi Ann. [Italy] Min. Agr.*, 1 (1921), No. 1, pp. 56-62).—In 1920, meteorological stations were started at about six points for the purpose of noting weather data and of giving notice of *Peronospora* outbreaks, with a view both to economize on spraying and to minimize loss from *Peronospora*. The information as collected and here discussed in some detail is said to show practical advantage derived from this service during its first year.

Bacteriosis (a new disease) of banana, V. ZEMAN (*Rev. Facult. Agron. La Plata, 3. ser., 14 (1921), No. 2, pp. 17-30, figs. 5*).—Recent study of a so-called rot of banana known in South America for some years has resulted in the identification of a hitherto undescribed bacterium. This is claimed as the causal agent and has been named *Bacillus musarum* n. sp. A *Fusarium* has also been found in connection with the disease, which is preferably called a bacteriosis. Forms attacked include *Musa cavendishii*, *M. sapientium*, and *M. paradisiaca*, the first named showing some degree of resistance to the disease.

Citrus canker eradication in Florida, W. NEWELL (*Fla. Dept. Agr. Bien. Rpt., 15 (1917-18), pt. 1, pp. 157-161; also in So. African Fruit Grower and Smallhold., 6 (1919), No. 10, pp. 297, 298*).—A condensed account is given of work, expenditure, and results in the campaign against citrus canker in Florida, from its appearance in 1913 to its supposed virtual eradication by June 30, 1918.

Report on eradication work in cooperation with the Bureau of Plant Industry for quarter ending June 30, 1921 (*Fla. Plant Bd. Quart. Bul., 5 (1921), No. 4, p. 173*).—This report shows no case of citrus canker appearing since August, 1919, except the 539 cases in one grove noted for July, 1920, in a report covering October, 1920. (*E. S. R., 46, p. 48*), and one case occurring in August, 1920. However, five properties were still classed as infected (not known to be free from canker) June 30, 1921.

A serious disease of almond trees, B. PEYRONEL (*Nuovi Ann. [Italy] Min. Agr., 1 (1921), No. 1, pp. 27-44, figs. 7*).—A fungus (*Fusicladium amygdali*) causing crop loss following twig infection and resulting leaf cast is discussed in relation to other fungi and to protective measures, principally the application of strong copper or iron fungicides.

Observations on *Cytospora chrysosperma* in the Northwest, E. E. HUBERT (*Phytopathology, 10 (1920), No. 10, pp. 442-447*).—According to the author, the weather conditions during the unusually dry summers of 1917, 1918, and 1919 resulted in the widespread and abundant appearance of *C. chrysosperma* on certain forest, shade, and ornamental trees in the Northwest. This disease, which has been previously described by Long (*E. S. R., 39, p. 357*), attacks poplars, willows, maples, and certain other trees and shrubs. Isolations of the fungus were made, and the organism was studied in relation to the host plants. It was found that infection usually followed some sort of injury resulting in low vigor of the trees. Such a condition is brought about by light ground fires, severe drought, etc.

As control methods, the author recommends the abandoning of willows, maples, and mountain ash for planting in regions subject to this infection, planting the most resistant species, watering regularly and abundantly, and rigid inspection of nursery stock to prevent the spread of the disease.

Safeguarding the white pine crop, S. B. DETWILER (*Amer. Forestry, 27 (1921), No. 325, pp. 7-11, figs. 8*).—This review of conclusions reached at the sixth annual International Blister Rust Conference notes some details not emphasized in the report by Detwiler and Moir (*E. S. R., 45, p. 549*).

As a result of experimental work during five seasons, it is stated decisively that removal of *Ribes* from the vicinity of pine stands effectively controls blister rust. The proof of this is rated among the most important data presented to the conference, this report being made by Pickler and Hodgkins as a result of reinspection of the control area at Lenox, Mass.

The cultivated black currant is so highly susceptible to blister rust and produces such numbers of spores that it was declared by the conference to be a serious public nuisance and detrimental to the growing of white pine. It was advised, therefore, that State legislation be provided for the general destruc-

tion of this species in pine-growing sections. The conference urgently recommended the removal of all currant and gooseberry bushes within 200 yds. at least from white-pine stands. Reports of extensive surveys made in the Northeastern States during 1920 showed that over large areas 10 per cent of the pines, on the average, are already attacked by blister rust. The first infection on these areas dates back to 1906 in some cases and up to 1911 in others.

In Wisconsin and Minnesota white-pine blister rust is widely distributed on currants and gooseberries, attacking pines at a number of points. An account is given of efforts at eradication, which have at least succeeded in bringing the disease under control.

The Rocky Mountain and Pacific Coast forests appeared to be free from the white-pine blister rust.

Studies on the rate of growth and behavior of the blister rust on white pine in 1918, A. S. RHOADS (*Phytopathology*, 10 (1920), No. 12, pp. 513-527).—The results are given of field studies conducted at Kittery Point, Me., during the spring and summer of 1918. The studies were undertaken with a view to determining the rate of growth and behavior of the blister rust cankers, and although the investigations were carried on for but a single year, the results are believed to be typical of the behavior of blister rust on the white pine.

Overwintering of *Marsonia juglandis*, B. PEYRONEL (*Staz. Sper. Agr. Ital.*, 53 (1920), No. 4-5, pp. 168-171).—Evidence is presented supporting the view that *M. (Gnomonia) juglandis* may overwinter in the conidial form in branches and shoots of walnut trees.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

Migratory bird refuges and public shooting grounds (*U. S. House Represent.*, 67. Cong., 2. Sess., Com. Agr., *Hearings on Migratory Bird Refuges [etc.]*, 1922, pp. 69).—This is a report of the hearings before the Committee on Agriculture, House of Representatives, on February 16-17, 1922.

The migration of North American birds, XVIII, compiled by H. C. OBERHOLSER (*Bird Lore*, 24 (1922), No. 2, pp. 85-88).—This paper, continuing the series previously noted (*E. S. R.*, 46, p. 456), records the migration of the many forms of the red-winged blackbird.

Glimpses of desert bird life in the Great Basin, H. C. OBERHOLSER (*Smithsn. Inst. Ann. Rpt.*, 1919, pp. 355-366).

Habits and metamorphoses of insects, E. L. BOUVIER (*Habitudes et Métamorphoses des Insects*. Paris: Ernest Flammarion, (1921), pp. 321, fig. 1).—The several parts of this book deal with alimentation in insects, means of defense and protection, and conservation of the species.

[Papers on insects and insect control] (*Min. Agr. [France], Ann. Épiphyties*, 7 (1919-1920), pp. 117-266; 323-441, pls. 21, figs. 70).—An account of the occurrence of insects during the years 1919-1920 forms part of a report by the directors of the Entomological and Plant Pathological Stations of Paris. Papers which relate to economic entomology (*E. S. R.*, 45, p. 454) are as follows:

The Fight Against the Moroccan Locust (*Doclostaurus maroccanus* Thumb.) in Crau in 1920, by P. Vayssière (pp. 117-168); The Simultaneous Treatment of Plant Diseases and Insect Enemies of Fruit Trees by Spray Mixtures, by A. Paillot (pp. 169-194); Experiments with Spray Mixtures for Fruit Trees, by J. Feytaud (pp. 195-236); The Argentine Ant (*Iridomyrmex humilis argans* Sant.) in the South of France, by C. Chopard (pp. 237-266); Investigations of the Eudémis and Cochyliis moths in Bordeaux in 1918 and 1919, by J. Feytaud (pp. 323-338); Insects Injurious to Cultivated Plants in Morocco,

by P. Vayssière (pp. 339-370); The Rouen Entomological Station (pp. 371-376), An Enemy of Poplar, *Idiocerus populi* L., The Poplar Leafhopper (pp. 377-385), and The Raven Problem in Normandy (pp. 386-390), all by R. Régnier; Biological Observations of the Olive Fly and Its Parasites in the Menton Region, by R. Poutiers and L. Turinetti (pp. 391-397); Investigations of the Use of Chloropicrin as an Insecticide, by B. Trouvelot (pp. 398-404); and summarized reports on the work accomplished by the entomological stations at Paris, Blois, Bordeaux, Montpellier, Saint-Genis-Laval, and Rouen, etc. (pp. 421-438).

Collected leaflets on insect pests of fruit trees (London: Min. Agr. and Fisheries, 1921, pp. 100, pls. 10, figs. 51).—This consists of summarized accounts of about 40 of the more important insect pests occurring in Great Britain.

Forest insect problems of the Pacific slope, A. J. JAENICKE (*Jour. Econ. Ent.*, 14 (1921), No. 5, pp. 447-450).—A brief survey by the forest examiner of the U. S. D. A. Forest Service.

The insects that transmit disease in Venezuela, M. NUÑEZ TOVAR (*Insectos Venezolanos Trasmisores de Enfermedades*. Caracas: State, 1921, pp. 54, pls. 2).—This account, presented at the Third Medical Congress in Venezuela, in June, 1921, deals largely with the Culicidae, particularly Anopheles, and other blood-sucking dipterans. Other insects briefly considered include several hymenopterans and ixodids.

The war against insects, L. O. HOWARD (*Chem. Age* [New York], 30 (1922), No. 1, pp. 5, 6, fig. 1; also in *Nature* [London], 109 (1922), No. 2725, pp. 79, 80).

Dust insecticides in California, E. O. ESSIG (*Jour. Econ. Ent.*, 14 (1921), No. 5, pp. 392-394).—This is a discussion of the use of nicotin dust, accounts of which by Campbell (*E. S. R.*, 44, p. 651) and by Smith (*E. S. R.*, 46, p. 350) have been noted.

Notes on the use of nicotin dusts, A. W. MORRILL (*Jour. Econ. Ent.*, 14 (1921), No. 5, pp. 394-400).—This account of the use of nicotin dust in California relates particularly to its use against the grape leafhoppers, the melon aphid, and the woolly apple aphid.

Spreading and adherence of arsenical sprays, W. MOORE (*Minnesota Sta. Tech. Bul.* 2 (1921), pp. 3-50, fig. 1).—This account is based upon an extensive review of the literature and investigations conducted by the author.

"The addition of material similar in chemical constitution to the leaf surface causes the spray mixture to form a film of liquid over the leaf. The positive adsorption of the added material at the leaf-spray interface, resulting in a lowering of the interfacial tension, appears to offer the best explanation of the results. Different types of leaves naturally require different materials. Thus organic compounds such as beechwood creosote, carvacrol, or amyl alcohol, soluble in fats and waxes and but slightly soluble in water, produce good spreading over waxy leaves such as cabbage. Various proteins and plant infusions give good spreading on leaves with surfaces of cellulose even when they are strongly cutinized as in the case of plum and citrus leaves. Suspensions containing small-sized particles adhere better than those with larger particles. An even distribution of the spray over the leaf tends to increase the adherence."

In the latter part of the work, which deals with the adherence of spray materials to the leaf, the author advances a new reason as to why the adherence of one material to the leaf is superior to that of another. He has demonstrated that the leaf surface assumes when wet a negative electric charge, and that suspensoids of the common arsenic compounds ionize in such a way that their particles are also negative. Field tests have confirmed the assumption that spray materials carrying positive electric charges will adhere to the negatively charged leaf surface better than materials exhibit-

ing negative charges. Positive arsenic preparations of different elements were prepared and tested, and ferric arsenate was found to be the most promising material and more toxic than lead arsenate. The presence of ferric hydroxid in the spray material is not desirable since, owing to its adsorption of arsenic, it lowers the toxicity of the preparation.

"The common compounds of arsenic, such as lead arsenate, Paris green, calcium arsenate, and others, have particles carrying negative electric charges. Arsenic compounds of aluminum, chromium, and iron may be prepared so that the particles carry a positive charge.

"As shown in tests with locusts, the ratio of the amount of the arsenic compound in the body to that in the excreta is a better basis of comparing toxicity of different arsenical preparations than tests based on the food consumed or the time required to produce death."

A list of the literature cited, covering 5 pages, is appended.

Cold storage control of insects, E. R. DE ONG (*Jour. Econ. Ent.*, 14 (1921), No. 5, pp. 444-447).—This is a brief discussion of the subject.

The seventeen-year locust, R. E. SNODGRASS (*Smithsn. Inst. Ann. Rpt.*, 1919, pp. 381-409, pls. 5, figs. 9).—This is a report of extended studies of *Tibicina septendecim* made during the season of 1919 at Somerset, Md., which is illustrated by pen drawings and colored plates. The subject is dealt with under the headings of underground life, transformation, the adults, song, egg laying, death, internal anatomy, and hatching.

Proceedings of the International Conference for the Organization of Work Against Locusts (*Actes de la Conférence Internationale pour l'Organisation de la Lutte Contre les Sauterelles*, 1920. Rome: *Inst. Internatl. Agr.*, 1921, pp. 171).—This report of the proceedings of the conference held at Rome, Italy, October 28-31, 1920, includes papers by S. Pouleff on combating locusts in Bulgaria (pp. 150, 151), by Gilin on control work in Tunis (pp. 152, 153), and by P. Vayssière on the work in Morocco in 1920 (pp. 154-157).

Report of control work with locusts in Uruguay from 1917 to 1920, R. SUNDBERG (*Uruguay Defensa Agr. Mem.*, 1917-1918, pp. 89, pls. 7; *Uruguay Defensa Agr. Bol. Mens.*, No. 1 (1920), pp. 8, 9; *abs. in Internatl. Inst. Agr. [Rome], Internatl. Rev. Sci. and Pract. Agr.*, 11 (1920), No. 10, pp. 1210-1213).—The usual reports (E. S. R., 37, p. 849) on the occurrence of locusts and measures for their control, etc.

Thrips injury to peaches in southern California, G. P. WELDON (*Jour. Econ. Ent.*, 14 (1921), No. 5, pp. 424-428).—A species of thrips thought to be *Euthrips helianthi*, first observed in Placer County in the fall of 1914, became in 1920 a source of great injury to peaches. The adult thrips enter the blossoms as soon as they open in the spring and the eggs are deposited. The adults and larvae feed during the blooming period and until the time the husks are shed from the little peach, practically all the injury taking place before the shedding of the husks. It was found in spraying experiments with nicotin sulphate distillate emulsion mixture that not over 50 per cent of the thrips were killed, because of the difficulty in getting the spray into the blossoms. Negative results were also secured in 1920 and 1921 from the use of Nicodust.

The hog louse, *Haematopinus suis* L.: Its biology, anatomy, and histology, L. FLORENCE (*New York Cornell Sta. Mem.* 51 (1921), pp. 641-743, figs. 78).—Following a brief historical review, the author gives an account of the biology of the hog louse (pp. 644-651) and then an extended discussion of its internal anatomy and histology. The eggs, which are laid one at a time and attached to the bristles of the hog by a clear cement, hatch in from 12 to 20 days. In the course of its development, this louse undergoes three molts. The first occurs after 5 to 6 days, the second after 4 days, and the third after 4

to 5 days, and sexual maturity after 3 days. The time of development from first-stage larva to the mature adult was from 16 to 18 days, and the duration of the life cycle from egg to egg was 29 to 33 days. There were from 1 to 4 feedings during a period of 24 hours.

The relation between the parasite and its host has not been considered, and no references are given to veterinary literature in the appended bibliography of seven pages.

Monograph of the North American species of *Deraeocoris* (Heteroptera, Miridae), H. H. KNIGHT (*Minnesota Sta. Tech. Bul.* 1 (1921), pp. 75-210, figs. 47).—In the present paper the author recognizes 54 species and 22 varieties of *Deraeocoris* from North America, of which 37 species and 20 varieties are described as new. A key is presented for seven groups of species of the genus, and keys are given for each group. Notes are also presented on two species which have been described and placed in the genus *Deraeocoris*, but belong to other genera, and the genus *Deraeocapsus* is erected, of which *Deraeocoris ingens* Van D. is the genotype. An 11-page list of the literature cited and an index to the species by groups are included.

Summary of life history of beet leafhopper (*Eutettix tenella* Bak.), H. H. P. SEVERIN (*Jour. Econ. Ent.*, 14 (1922), No. 5, pp. 433-436).—This is a review of the status of knowledge of the beet leafhopper, reports of studies of which by the author have been previously noted (*E. S. R.*, 41, pp. 456, 755).

The life history of the beet leafhopper, H. H. P. SEVERIN (*Facts About Sugar*, 14 (1922), Nos. 5, pp. 92, 93, figs. 6; 6, pp. 110, 111, figs. 7; 7, pp. 130, 131, figs. 2; 8, pp. 152-154, 158; 9, pp. 170, 171).—This is a report of further studies (*E. S. R.*, 41, pp. 456, 755) of *Eutettix tenella* Bak., conducted by the author in the San Joaquin Valley, Calif. These studies show the incubation period to vary from 11 to 55 days from February to October, the nymphal period of the first brood from 23 to 37 days from April to October, and the egg and nymphal periods combined from 37 to 99 days. Eggs deposited from November 1 to January 15 failed to hatch, or the nymphs died out of doors. There was a high mortality during the winter of the nymphs which hatched out from eggs deposited during September and October. A total of 328 eggs were deposited by a single female of the first generation.

"Four generations were bred from the dark females which wintered over in the cultivated area. After the flight of the pale green adults of the first brood from the plains and foothills into the cultivated area, four more generations were bred, or a total of five broods. The months of maximum emergence of the first to the fourth broods bred from the dark females were the same as those in which the second to the fifth generations were reared from the pale green leafhoppers, as follows: June-July, July-August, September-October, and October-November."

Experiments with a dusting machine to control the beet leafhopper (*Eutettix tenella* Bak.) with nicotin dust, H. H. P. SEVERIN ET AL. (*Jour. Econ. Ent.*, 14 (1921), No. 5, pp. 405-410).—A dust containing 8 per cent Blackleaf 40 applied with an American Beauty hand duster to 4 cages killed from 87 to 97 per cent of the leafhoppers. A few adults recovered, but most of them died in from 20 to 45 hours. A dust containing 10 per cent Blackleaf 40 applied with a dusting machine at the rate of about 100 lbs. to the acre caused an average mortality of 69 per cent by the end of 7 hours, 83.3 per cent at the end of 24 hours, and 92.6 per cent at the end of 48 hours.

"Preliminary experiments conducted with a dusting machine in a beet field at King City [Calif.] showed that dust mixtures about six weeks old kept in closed tin receptacles and containing from 6 to 10 per cent of Blackleaf 40 were not as effective as the newly made material. . . . No conclusions can

be drawn as to the value of dust mixtures as a method of control for the beet leafhopper due to the fact that the beets were planted after the invasion into the cultivated area had occurred."

Anuraphis helichrysi Kalt., a pest of prune, plum, and red clover in Idaho. R. H. SMITH (*Jour. Econ. Ent.*, 14 (1921), No. 5, pp. 422, 423).—This is the most important aphid enemy of the prune and plum in Idaho, where red clover and garden asters, the most important summer host plants, are frequently very heavily infested. Its injury to clover during the summer of 1921 caused a marked reduction in the yield of seed in fields near Twin Falls. Blackleaf 40 used at the rate of 0.75 pt. to 100 gal. of water with soap as a spreader or to 100 gal. of dilute lime sulphur solution applied just before the buds open on prune and plum has given perfect control.

Observations on the biology of apple aphids, F. H. LATHROP (*Jour. Econ. Ent.*, 14 (1921), No. 5, pp. 436-440).—This is a brief account of observations of *Aphis avenae* Fab., *A. pomi* DeG., and *A. sorbi* Kalt. at the Oregon Experiment Station, in continuation of those at the New York State Experiment Station, previously noted (*E. S. R.*, 35, p. 757).

An explanation of recent failures in San José scale control, W. A. RUTH (*Illinois Sta. Circ.* 252 (1922), pp. 4).—The author discusses the basis for the increase in the number of reports of unsatisfactory control of the San José scale by spraying that have been received by the station in the past two or three years. The studies have brought out the fact that while failures are common in southern Illinois they are exceptions in the northern part of the State. It is pointed out that growers throughout the State are spraying their trees with very small quantities in comparison with the amounts used experimentally, the amount of spray most often applied being about one-third that required to cover the trees heavily. While the use of these small amounts does not seem to cause trouble in northern Illinois, it is a most likely explanation of the failures which are occurring in the southern part of the State.

Life history of the codling moth in walnuts at Santa Ana, Calif., H. J. QUAYLE (*Jour. Econ. Ent.*, 14 (1921), No. 5, pp. 440-444).—In addition to the observations on the life history of this pest at Santa Ana, a brief reference is made to its seasonal history at Carpinteria, Calif.

Miscible oils and fruit-tree leaf-roller, J. R. PARKER (*Better Fruit*, 16 (1922), No. 9, pp. 7, 8, 21).—This paper includes information on *Archips argyrospila* additional to that given in the account previously noted (*E. S. R.*, 46, p. 157).

In spraying experiments in 1921 several kinds of miscible oils were tested, of which Dormoil at a strength of 1:11.5 gave the best results in both winter and spring spraying tests. Practically no spray injury resulted from its use at this strength, and leaf-roller injury to the foliage was so reduced that it was scarcely noticeable. Universal Brand Dormant Soluble Oil gave fair results in the second spring spraying but very poor results in the winter and first spring spraying. It also caused some spray injury, and the injury to the foliage resulting from the work of the leaf-roller larvae was enough to give all the trees a ragged appearance. Scalecide gave poor results in all tests. Spramulsion, even though used much stronger than any of the other oils, gave very poor results.

The results of using certain oil sprays for the control of the fruit-tree leaf-roller in the Pajaro Valley, Calif., D. D. PENNY (*Jour. Econ. Ent.*, 14 (1921), No. 5, pp. 428, 433).—The best results obtained with any oils in the tests here reported were obtained from the emulsion of the Pennsylvania Gas Oil, 10 per cent of which gave an 80.9 per cent kill in the sprayed plat. The Ortho brand of western crude oil emulsion gave a 50 per cent kill on trees sprayed

with the customary 12 per cent of oil. In the 97.7 per cent kill obtained with the 15 per cent Ortho crude oil sample all but one egg in one mass failed to hatch, which makes the actual kill very close to 100 per cent.

Life history of *Ethmia macelhosiella* Busck, A. BUSCK and C. HEINRICH (*Ent. Soc. Wash. Proc.*, 24 (1922), No. 1, pp. 1-9, figs. 15).—This lepidoteran, an account of the life history of which is here considered, was found to develop on the leaves of a species of *Phacelia*.

The seasonal history of *Anopheles occidentalis* D. & K. in California, S. B. FREEBORN (*Jour. Econ. Ent.*, 14 (1921), No. 5, pp. 415-421, fig. 1).—This is a report of studies made during the years 1919 and 1920.

Arsenic as a larvicide for anopheline larvae, M. A. BARBER and T. B. HAYNE (*Pub. Health Rpts. [U. S.]*, 36 (1921), No. 49, pp. 3027-3034).—The authors have confirmed the work of Roubaud, an account of which has been previously noted (*E. S. R.*, 43, p. 853), in that trioxymethylene strewn on the surface of the water was found very toxic to anopheline larvae, both in laboratory and in field tests. This result led to an extension of the investigation with a view to discovering some substance that is cheaper and even more poisonous to the larvae. A considerable number of substances were tested, and compounds containing arsenic were found to be most promising, Paris green proving to be the most efficient.

A test was devised by which the toxicity of a substance for anopheline larvae could be quantitatively measured in the laboratory. This consisted in lightly strewing the powder to be tested upon the surface of the water in a Petri or other convenient dish, after which a larva was pipetted into the dish, and the time when the particles of powder began to be swept into the mouth of the larva was carefully observed. At the end of a given feeding period the larva was pipetted out, washed, and deposited in a second dish for observation.

As pointed out by the authors, the possible advantages of arsenic dust used against anopheline larvae are its cheapness, portability, ease of distribution by means of the wind, and the possibility of using it over areas difficult of treatment by methods now in use. The chief disadvantage is that its use is limited to anopheline larvae, ova, and pupae of all kinds, and that culicine larvae are apparently unaffected. It is believed that this method will have a place in antimalarial work, especially in areas not easily drained and so covered by vegetation or other obstacles as to render them inaccessible to natural enemies of larvae or to other methods of treatment.

Life histories of Indian insects.—Diptera: *Sphyracephala hearseiana* Westw., S. K. SEN (*India Dept. Agr. Mem., Ent. Ser.*, 7 (1921), No. 6, pp. 33-38, pls. 2).—This is a report of observations on the life history of the syrphid *S. hearseiana*, made at Pusa in March.

Two mechanical devices for controlling western cucumber beetles, R. E. CAMPBELL and W. H. NIXON (*Jour. Econ. Ent.*, 14 (1921), No. 5, pp. 400-404, fig. 1).—A hopperdozer invented for use against *Diabrotica soror* Lec., a universal feeder, is described. With this apparatus a man with one horse has covered 30 acres per day at a very low cost per acre. The machine is serviceable for capturing the beetles infesting any low-growing crop, such as beans, beets, cucumbers, etc., grown in rows, and also such crops as alfalfa up to the time it is about half grown.

A similar machine on the same general plan was developed which proved entirely satisfactory for use against *D. trivittata* Mann.

Biological notes on *Desmocerus*, a genus of roundhead borers, the species of which infest elders, H. E. BURKE (*Jour. Econ. Ent.*, 14 (1921), No. 5, pp. 450-452).—These notes relate to four western and one eastern species of the

genus *Desmocerus*, all of which bore in the pits and wood of living shrubs or trees of various species of elder (*Sambucus*).

The specific names of two otiorhynchid weevils of Florida, E. A. SCHWARZ and H. S. BARBER (*Ent. Soc. Wash. Proc.*, 24 (1922), No. 1, pp. 29, 30, figs. 2).—This paper relates to the names of two species of *Pachnaeus*.

The larva of the North American beetle *Zenodosus sanguineus* Say of the family Cleridae, A. G. BÖVING and A. B. CHAMPLAIN (*Ent. Soc. Wash. Proc.*, 24 (1922), No. 1, 9–11, figs. 11).

A list of phytophagous Chalcidoidea with descriptions of two new species, A. B. GAHAN (*Ent. Soc. Wash. Proc.*, 24 (1922), No. 2, pp. 33–53, figs. 2).—Following a brief introduction, the author presents a species catalogue of phytophagous chalcidoids other than the fig insects (pp. 38–49), a host plant list arranged in alphabetical order (pp. 49–54), and descriptions of two new species, namely, *Rhycinopeltella eucalypti* from galls on *Eucalyptus globulus* at Wellington, New Zealand, and *Harmolita phyllotachitis* from young stems of bamboo (*Phyllostachys bambusoides*) at Brooksville, Fla.

The identity of a hymenopterous parasite of the alfalfa leaf weevil, R. A. CUSHMAN (*Ent. Soc. Wash. Proc.*, 24 (1922), No. 2, p. 64).—A parasite reared from *Phytonomus posticus* at Hoytsville, Utah, and described by Viereck as *Aenoplegimorpha phytonomi* has since been reared from the same host in Italy, and has been identified by the author as *Hemiteles micator* Grav., a European species.

Notes on the oviposition and habits of the Iris sawfly, *Rhadinoceraea micans* Klug, H. SCOTT (*Ent. Mo. Mag.*, 3. ser., 7 (1921), No. 82, pp. 229–232).—These notes relate to a sawfly, first recorded from Great Britain in 1904, which has been found abundantly on the wild yellow flag (*Iris pseudacorus*) at Woking, England. They deal with certain points in its life history and particularly with the method of oviposition. While *I. pseudacorus* is its normal food plant, it will also feed on other species of *Iris* in gardens.

Isle of Wight disease in hive bees (*Roy. Soc. Edinb. Trans.* 52 (1920–21), No. 4, pp. 737–779, pls. 3, figs. 2).—This subject is dealt with in four papers:

I. *The etiology of the disease*, J. Rennie, P. B. White, and E. J. Harvey (pp. 737–754).—The authors first review briefly the occurrence of the Isle of Wight bee disease and the investigations that have been made of it, with references to the literature. They announce the discovery that a parasitic mite invades the respiratory system of the adult bee. Exhaustive investigations have led them to conclude that this mite is the causal agent of the disease. This previously undescribed mite, which Rennie has identified as belonging to the genus *Tarsonemus*, was first observed by one of the authors (Harvey) in December, 1919, at which time a single example was found in a portion of trachea present in a preparation of the thoracic glands. The following May another of the authors (White) discovered it to occur in all stages of development in certain of the major thoracic tracheae of affected ("crawling") bees. Notwithstanding variations in the course of the disease in different stocks, the authors consider it as established that there is an invariable association of the parasite with diseased stocks, and that there is a definite pathology in relation to infestation in the individual bee. The development of the disease was traced within bee colonies from the earliest stages of infestation to its complete manifestation in "crawling" and other definite symptoms. They have observed that the total effects resulting from its feeding upon the bee and life generally within it renders it useless as a working unit, disorganizes its social system, and eventually shortens the bee's life. In extensive investigations of stocks suffering from Isle of Wight disease, they have always found this parasite present. Of 36 per cent of supposed

healthy stocks in which it was found present, a proportion eventually developed the usual symptoms and died from the disease.

II. *The pathology of Isle of Wight disease in hive bees*, P. B. White (pp. 755-764).—It is pointed out that Isle of Wight disease is primarily an infection of the respiratory system, in which the organism remains localized throughout the entire course of the attack. Imperfect oxygenation and possibly malnutrition and a toxic condition are the main factors in the disease as now known.

III. *Isle of Wight disease in hive bees: Experiments on infection with Tarsonemus woodi* n. sp., E. J. Harvey (pp. 765-767).—The results obtained by the author show that experimental infestation with this mite by direct contact between bee and bee is difficult to effect. It appears to be unusual for the mites to enter the cell and invade the bee body before the bee emerges therefrom. The experiments indicate that migration of both sexes takes place from the dead bee.

IV. *Isle of Wight disease in hive bees: Acarine disease; the organism associated with the disease, T. woodi* n. sp., J. Rennie (pp. 768-779).—In this paper the author presents a technical description of the parasitic mite which causes the disease under the name *T. woodi* n. sp. In considering the biology of this species, brief references are made to the habits of the best known species, including both plant and animal attacking species. In none of hundreds of bees received from Italy, Holland, Switzerland, and North America has this parasite been found to be present. Examinations made of a number of other insects have failed to show the presence of any parasite within the thoracic tracheae. In the course of the investigations, at least five different species of mites were found in hives or upon combs, dead, or live bees.

In a later account of this mite, previously noted (E. S. R., 46, p. 464), Hirst places it in the new genus *Acarapis*.

The occurrence of diseases of adult bees, E. F. PHILLIPS (*U. S. Dept. Agr., Dept. Circ. 218* (1922), pp. 16, figs. 2).—This circular consists largely of a discussion of the Isle of Wight disease, in which attention is called to the work conducted in England indicating that *Acarapis woodi*, described by Rennie in the paper above noted and referred to by Hirst (E. S. R., 46, p. 464), is the causative agent. In a survey during the summer of 1921, in which examinations were made of 200 samples from 161 towns in 146 counties in 41 States, no indication was found of the presence of this mite in the United States. A shipment from England to Washington, D. C., consisting of a queen bee and attendants in queen mailing cages demonstrated conclusively that it is an easy matter to import the living mites into this country. Examinations showed living mites to occur in worker bees after they had been dead for several days. The prohibition or restriction in the importation of adult bees into this country as a means of preventing the introduction of the mite is discussed.

Nosema disease, caused by *Nosema apis*, is considered (pp. 9-12), and it is concluded that, due to its present wide distribution and its mild character, it is not necessary that any quarantine measures be applied against it.

In a brief reference to arsenical poisoning (pp. 12, 13), it is stated that there is reason to think that in some instances serious results have come from its use.

The circular includes a list of 23 references to the literature.

Notes on acarine disease, VIII, IX, J. RENNIE (*Bee World*, 3 (1921), No. 7, pp. 180-182, fig. 1; 3 (1922), No. 8, pp. 204-206, figs. 2).—These further notes on the subject (E. S. R., 46, p. 464) deal, respectively, with the habits of some

Tarsonemidae, bees as mite carriers, confusion in mite diagnosis, the identification of (*Tarsonemus*) *Acarapis woodi*, and profitable diseased stocks and their problems.

FOODS—HUMAN NUTRITION.

Food products, their source, chemistry, and use, E. H. S. BAILEY (*Philadelphia: P. Blakiston's Son & Co., 1921, 2. ed., rev., pp. XVI+551, figs. 92*).—The principal changes in the second edition of this book (E. S. R., 32, p. 353) consist in the condensation of the chapter on alcoholic beverages and a revision of the chapters on animal and vegetable fats and oils, and on nuts, cereals, and cereal products. The statistics of production and use of foods have in general been brought down to 1919.

Practical physiological chemistry, P. B. HAWK (*Philadelphia: P. Blakiston's Son & Co., 1921, 7. ed., rev., pp. XIV+675, pls. 6, figs. 192*).—Of interest in this revision (E. S. R., 40, p. 308) is the inclusion in the section on metabolism of directions for the care and caging of experimental rats and the technique for experimental work on the detection of dietary deficiencies, particularly vitamins.

Preventive medicine and hygiene, M. J. ROSENAU (*New York and London: D. Appleton & Co., 1921, 4. ed., rev., pp. XXXII+1567, figs. 194*).—Changes of particular interest in the fourth edition of this volume (E. S. R., 38, p. 882) are the extension of the chapter on some general considerations in the section on preventive and communicable diseases into a separate section on public health measures and methods; the revision of the subsections on food poisoning, botulism, and deficiency diseases; and the addition of a laboratory course in preventive medicine and hygiene.

Subtropical esculents, M. C. GRABHAM (*Lancet [London], 1921, II, No. 27, pp. 1357-1362*).—A brief description is given of the vegetable foods and edible fish to be found in Madeira. It is noted that the natives of this island do not suffer from the so-called deficiency diseases. This is attributed to the wealth and variety of vegetables and fruits included in their diet.

The energy value of some dried fruits, A. A. RAMSAY (*Agr. Gaz. N. S. Wales, 33 (1922), No. 1, pp. 57, 58*).—Data are presented on the percentage composition and calculated energy value of dried apricots, peaches, nectarines, pears, and prunes.

Studies of the bacterial flora of home canned vegetables, H. L. LANG (*Jour. Home Econ., 13 (1921), No. 9, pp. 448, 449*).—Bacteriological examinations were made of 938 cans of vegetables (peas, corn, Lima beans, asparagus, string beans, spinach, chard, okra, field peas, carrots, summer squash, and tomatoes), packed under home conditions, of which 302 were spoiled and 636 were in good condition. Some of the vegetables were packed in tin, but most of them in glass. About 10 per cent of the cans were processed under steam pressure, but the majority were processed in a water bath. The following results are reported:

"Home canned vegetables in first-class condition are not necessarily sterile, but frequently contain the spores of resistant soil bacteria. These spores, however, do not cause spoilage provided the can has a good vacuum and the seal remains tight. Living, vegetative bacteria are not found in canned goods of good quality, except in the case of leaky containers. Yeasts were found only twice and then were isolated from leaky cans. Molds were isolated from about 5 per cent of the spoiled cans, where the seal had been broken.

"Three groups of bacteria occur in home-canned foods; aerobic species, anaerobic species, and thermophilic bacteria, the latter including both aerobes and facultative anaerobes. The following species of aerobic soil bacteria were iso-

lated: *Bacillus subtilis* (Ehrenberg), isolated 120 times; *B. mesentericus* (Flügge), isolated 115 times; *B. vulgatus* (Flügge), isolated 96 times; *B. megatherium*, isolated 28 times; *B. cereus*, isolated 25 times; *B. vaculatus*, isolated 12 times; and *B. mycoides*. Twelve other members of the *B. subtilis-mesentericus* group not corresponding to any of the known species were isolated. All anaerobic bacteria found produced gas vigorously in dextrose media at 37° C. The most frequent cause of spoilage was one strain (or possibly several closely related strains) of butyric acid organisms isolated from 185 cans of spoiled corn, peas, and Lima beans. Spores of this organism resisted 100° C. for six hours, as well as intermittent processing at 100° for one hour at intervals of 18 and 24 hours. *B. uelchii* was isolated several times. Eight strains of true thermophilic bacteria and 7 strains of facultative thermophiles were isolated. These probably play a part in the spoilage of canned goods, since they may develop during the heating and cooling of the cans between 40 and 60°.

"The frequency of occurrence of the spores of bacteria in cans of good quality varied from 20 per cent in the case of tomatoes to 80 per cent in the case of spinach. Spores of the *B. subtilis-mesentericus* group were able to withstand 100° for periods varying from 5½ to 10 hours. Four successive heatings at 100° for 1 hour and 1½ hours, both at intervals of 18 hours and 24 hours, also failed to kill the spores of some strains.

"No organisms resembling *B. botulinus* in its cultural or morphological characteristics were found. Anaerobic butyric acid bacteria were not isolated from cans of good quality."

The "black spot" of chilled and frozen meat, F. T. BROOKS and M. N. KIDD ([*Gt. Brit.*] *Dept. Sci. and Indus. Research, Food Invest. Bd. Spec. Rpt. 6* (1921), pp. 6, pl. 1).—This is the report of an investigation of the "black spot" of chilled meat previously found by Massee (*E. S. R.*, 28, p. 659) to be caused by the growth of the fungus *Cladosporium herbarum*.

Preliminary experiments on the conditions under which the "black spot" fungus will grow in cold storage have shown that it is capable of growing and producing black spots on meat kept at a temperature which does not rise above 22° F. If meat inoculated with the fungus is kept at room temperature for from 24 to 48 hours before being placed in cold storage, the development of the fungus is much more rapid than when the meat is placed in storage immediately after inoculation. At the freezing point the development of the fungus is much more rapid than at lower temperatures, consequently fluctuations in the temperature of the refrigerating room will alter the rapidity of growth of the fungus.

Abrasions of the meat seem to exercise no influence on the development of "black spot." The fungus develops particularly on the subcutaneous connective tissue, whether overlying muscle or fat. The fungus produces no toxic substances during growth, so that its presence does not render the meat dangerous or unfit for human consumption, but it may be accompanied by putrefactive bacteria which would make the meat unfit for use.

The effect of weather on milling, E. S. MILLER (*Amer. Miller*, '50 (1922), No. 2, pp. 152-154, figs. 2).—This article states that better flour is made in summer than when the weather is very cold, and that there is a falling off in the quality of flour after October. This is ascribed in part to a deterioration in quality of the wheat ground, the best wheat being received just after harvest, but is believed to be due also in large part to unfavorable weather conditions, especially with reference to temperature and humidity.

The author is of the opinion that "a practical humidifying system would be of great benefit to any mill, especially in the summer. Cool, moist air introduced into the milling system, particularly under the rolls, could not fail

to facilitate reducing and bolting, and prevent excessive evaporative loss. Yet it is probable that a little cooler air than that of the atmosphere, and wheat somewhat warmer than normal, would produce better results than either system used alone." Reference is made to experiments conducted at the Kansas Experiment Station, which seemed "to indicate that flour made from heated wheat has superior baking qualities, especially if the wheat is new."

Basal metabolism and ideal weight and pulse ratios, A. PETERSON and W. WALTER (*Jour. Amer. Med. Assoc.*, 78 (1922), No. 5, pp. 341-343, figs. 2).—A brief analysis is given of the results obtained in more than 2,500 observations of basal metabolism on about 1,200 subjects with regard to the question of the reliability of the Benedict portable apparatus, the relation of basal metabolism to thyroid activity, and the relation of pulse rate to basal metabolism.

Basal metabolism determinations by the gas analysis and the Benedict methods used interchangeably, one test following the other immediately, on 55 subjects have shown that the portable apparatus is reliable provided the breathing appliance is tight and free from annoyance, and the subject has rested all night, has been perfectly quiet for at least 20 minutes, and has fasted from 12 to 15 hours. It is considered that the test is best made at the bedside of the subject.

From the results obtained by charting basal metabolism against ideal weight in 1,087 subjects and comparing the deviations from standard metabolism with diagnoses of thyroid trouble, the conclusion is drawn that "the mass of evidence is against weight being influenced to any consistent degree by thyroid activity alone."

A definite correlation between basal pulse rate (or pulse rate in the fasting relaxed state) and basal metabolism was noted in most of the cases examined. The mean rate of basal pulse in men was 66 and in women 74. A basal pulse rate of over 82 in men or 90 and over in women has been found to be a cause for suspicion of hyperthyroidism.

Basal metabolism determination and its technical difficulties, H. M. JONES (*Jour. Lab. and Clin. Med.*, 7 (1922), No. 4, pp. 191-198).—This is a discussion of several sources of error and technical difficulties involved in basal metabolism determinations. In particular it is emphasized that any method to be dependable requires a duplicate test for a control, and that the technique should first be proved adequate by tests on known normal subjects.

The water balance of the body, L. G. ROWNTREE (*Physiol. Rev.*, 2 (1922), No. 1, pp. 116-169, figs. 2).—In this review the author discusses the literature on the water balance of the body from the standpoint of its definition "as the daily relation between the total amount of water entering the organism through the ingestion of liquids and food and the total output of water lost from the body by way of the kidneys, bowels, lungs, and skin. In the intake must be included the water of oxidation."

Among the many points discussed are the relative importance to life of oxygen, water, and food; the constitution of water; the nature of the sensation of thirst; factors determining the relative loss of water by various channels; and the effects of water deprivation and excessive ingestion of water, water intoxication. An extensive bibliography is appended.

Fat transport in the animal body, W. R. BLOOR (*Physiol. Rev.*, 2 (1922), No. 1, pp. 92-115).—This is a critical review of the literature on the subject under the main headings of fat transport across the intestinal wall, transport from the blood to the tissues, and passage from the tissues. A list of 71 references to the literature is appended.

The zinc and copper content of the human brain, M. BODANSKY (*Jour. Biol. Chem.*, 48 (1921), No. 2, pp. 361-364).—Continuing the study of the distribution of zinc previously noted (E. S. R., 46, p. 566), the author reports

analyses of four adult brains and a fetal brain. These indicate that copper and zinc are normal constituents of the human brain, and that there is probably a more rapid storage of these elements in the brain during intrauterine life than after birth.

The bacterial content of the stomach as influenced by saliva, N. KOPELOFF (*Soc. Expt. Biol. and Med. Proc.*, 19 (1921), No. 3, pp. 110-112).—Data are presented confirming the suggestion made in a previous paper (E. S. R., 46, p. 710) that the bacterial count of the stomach depends largely on the swallowing of saliva. By using an ordinary dental suction tube it was found possible to reduce the swallowing of saliva to a minimum. The bacterial count of samples of the stomach contents of the same subject under ordinary conditions and with the saliva removed showed consistently higher numbers in the former case.

Dietetics and public health, E. C. VAN LEERSUM (*Lancet [London]*, 1921, II, No. 24, pp. 1252-1254).—In this lecture, given before the Royal Society of Medicine, England, the author emphasizes the necessity of systematic propaganda in human nutrition, and cites as an example of such propaganda for national feeding the boys' and girls' club work developed by the States Relations Service, U. S. D. A. The value of the work of trained dietitians in hospitals and institutions is also emphasized.

Growth and reproduction upon simplified food supply.—II, Influence of food upon mother and young during the lactation period, H. C. SHERMAN and M. MUHLFELD (*Soc. Expt. Biol. and Med. Proc.*, 19 (1921), No. 2, pp. 76, 77).—In continuation of the studies previously noted (E. S. R., 45, p. 864), a comparison is briefly reported of the nutrition of rats into the second generation on diets containing, respectively, one-sixth whole milk powder to five-sixths ground whole wheat and one-third whole milk powder to two-thirds ground whole wheat. Evidences of improved nutrition on the latter diet are summarized as follows: "(1) Increase in the number of young produced, (2) increase in the percentage (and therefore also in the number) of young successfully suckled, (3) better maintenance of the body weight by the mother while suckling the young, (4) higher average weight of young at a standard weaning age of four weeks, and (5) more economical utilization of the calories of food consumed (as well as of the body material of the mother) in the rearing of the young to weaning age."

Studies of infant feeding.—XII, A study of the amounts of the individual mineral elements usually fed in modified milk formulas, with a consideration of the use of lime water in connection therewith, A. W. BOSWORTH (*Ann. Med.*, 1 (1921), No. 4, pp. 539-547).—This, a paper previously noted (E. S. R., 46, p. 261), and the two following papers continue the series of studies on infant feeding (E. S. R., 41, p. 561).

From data obtained in previous studies on the distribution of ash constituents in human and cow's milk, and from determinations of CaO , P_2O_5 , and citric acid in milk diluted with varying amounts of lime water, the author has calculated the available mineral elements in modified formulas of cow's milk furnishing varying amounts of protein from 0.75 to 2.5 per cent. A comparison of this tabulation with the ash constituents of breast milk shows that all modifications made by the use of cream and whole milk or skim milk which contain less than 2 per cent of protein are deficient in chlorin or potassium or both, and that all modifications containing more than 1.25 per cent of protein furnish an excess of available calcium. By the addition of from 25 to 50 per cent of lime water to the milk some of the excess calcium is precipitated as calcium phosphate. In such cases the formulas containing over 1.5 per cent of protein have an excess of available calcium.

In any modification of milk the protein content should be brought to as near 2 per cent as possible in order to furnish the right amount of chlorin and potassium, and lime water should be added in order to reduce the amount of calcium available for the formation of soap. It is also noted that all modified milk formulas containing less than 1.6 per cent protein are deficient in citric acid.

Studies of infant feeding.—XIV, Chemical studies of certain dry milk products used in infant feeding, A. W. BOSWORTH (*Amer. Jour. Diseases Children*, 22 (1921), No. 5, pp. 455-458).—A careful study of various commercial brands of dried milk has been made for purposes of comparison with fresh cow's milk in regard to their use in infant feeding. The analyses include determinations of moisture, fat, lactose, protein, citric acid, ash, chlorin, phosphorus, calcium, magnesium, sodium, and potassium.

The principal points brought out in these analyses are evidences of the addition in some of the products of either sodium carbonate or bicarbonate; removal before drying of some of the fat in the original milk, thus indicating that the product is not dry whole milk in a strict sense; and a loss of citric acid in nearly all the samples. The latter finding is not in harmony with the results obtained by Supplee and Bellis (*E. S. R.*, 46, p. 615).

A table is also given of the degree of solubility of some of the mineral elements in fresh cow's milk and in the dry milk products examined. No change was found in the solubility of chlorin, sodium, and potassium, but wide variations in the solubility of phosphorus, calcium, and magnesium were noted, the solubility in some cases being greater and in others less than in fresh milk. Attention is called to the fact that in all but one of the dry milk products examined there has been an increase in the percentage of soluble calcium. This change is thought to be an important factor to be considered in connection with the use of dry milk preparations for infant feeding, inasmuch as an excess of soluble calcium in cow's milk as compared with human milk is thought to be responsible for the soapy stools and protein curds eliminated by most bottle-fed infants.

Studies of infant feeding.—XV, The calcium of cow's milk in its relation to the digestion and absorption of casein. Protein curds in stools, A. W. BOSWORTH (*Amer. Jour. Diseases Children*, 22 (1921), No. 6, pp. 613-619).—Continuing the series noted above, evidence is presented that the hard protein curds sometimes found in the stools of bottle-fed infants are not produced as the result of any fault in the digestive functioning of the infant, but are caused by an excess of soluble calcium in the food or an excess of acidity which dissolves the normal insoluble calcium, thus increasing the content of soluble calcium. This results in the formation, through the action of rennin, of tough protein curds which are slowly and incompletely digested in the intestine and tend to be eliminated as such. Analyses of the protein curds present in the stools of some bottle-fed infants receiving modified cow's milk have shown them to be composed of protein in the form of paracasein, fat, and dicalcium phosphate.

The vitamins, H. C. SHERMAN and S. L. SMITH (*New York: Chem. Cat. Co., Inc.*, 1922, pp. III+273, pls. 4, figs. 14).—This volume, which is one of the series of scientific monographs published under the auspices of the American Chemical Society, reviews the history of the subject, the properties and distribution of the three now recognized specific vitamins, the relation of these vitamins to certain deficiency diseases, and their place in the problem of the food supply. Tables are given of the occurrence of each of the three vitamins as reported in the literature and of the relative values of different articles of food as sources of vitamins. An extensive bibliography is appended.

Factors influencing the vitamin content of foods, A. R. DUTCHER (*Jour. Indus. and Engin. Chem.*, 13 (1921), No. 12, pp. 1102-1104).—This and the six following papers were presented at a vitamin symposium at the annual meeting of the American Chemical Society in New York City in September, 1921.

In this paper the author emphasizes some of the factors which are of importance in influencing the vitamin content of foods. In foods of animal origin these are considered to be the diet of the animal previous to slaughtering, the type or species of animal, the type of tissue used as food, and the method of food treatment.

Standardized methods for the study of vitamins, A. D. EMMETT (*Jour. Indus. and Engin. Chem.*, 13 (1921), No. 12, pp. 1104-1106, figs. 3).—An urgent plea is made for a standardization of methods for the study of vitamins, such a standardization to include strict uniformity in the basal diets, with definite methods for the preparation of these diets; definite statements with regard to age, weight, sex, and physical condition of the experimental animals; regulation of the methods of feeding the animals and recording the food intake; the use in general of preventive rather than curative treatment; and the extension of the tests to cover a long enough period to obtain conclusive results.

Vitamins from the standpoint of structural chemistry, R. R. WILLIAMS (*Jour. Indus. and Engin. Chem.*, 13 (1921), No. 12, pp. 1107, 1108).—In continuation of his investigation of the chemical nature of vitamins (E. S. R., 37, p. 411), the author has tested the protective power against avian polyneuritis of a large variety of synthetic substances of which only trimethyluracil and 4-phenylisocytosin have shown any curative effects. In discussing these and earlier results, he states "whether this result or any of the physiological results so far obtained with synthetic substances has any real significance must be left to the reader's judgment. However, the solubilities, chemical reactions, and natural occurrence of vitamin B, so far as known, agree very closely with the pyrimidin bases, a class of substances known to be capable of a very delicate desmotropism. In view of these facts any suggestion of physiological activity in synthetic preparations of this group or its allies ought not to be lightly dismissed. The writer believes that vitamin B eventually will be found to be a cyclic nitrogen compound with an oxygen substitution in the ring and capable of existence in a betain configuration. If the work on synthetics offers any useful suggestions as to manipulation in the isolation or identification of the vitamin from natural sources it will have served an adequate purpose."

Vitamins from the standpoint of physical chemistry, V. K. LAMER (*Jour. Indus. and Engin. Chem.*, 13 (1921), No. 12, pp. 1108-1110).—A brief outline is given of investigations conducted in various laboratories on the solubility of the vitamins in different media; the adsorption of vitamins under varying conditions; the size of the particles which carry the vitamin activity or, more specifically, studies on ultrafiltration; and the stability of the vitamins under conditions in which time, temperature, hydrogen-ion concentration, radiant energy, and oxidizing agents are the independent variables. As an illustration of the stability studies as thus outlined, some details are presented of the investigation of the stability of the antiscorbutic vitamin by Sherman, LaMer, and Campbell noted in detail below.

The antiberiberi vitamin, C. FUNK (*Jour. Indus. and Engin. Chem.*, 13 (1921), No. 12, pp. 1110, 1111).—A general discussion.

Experiments on the isolation of the antineuritic vitamin, A. SEIDELL (*Jour. Indus. and Engin. Chem.*, 13 (1921), No. 12, pp. 1111-1115).—This paper describes in detail the method of preparing the stable silver vitamin compound which has been noted from a preliminary report (E. S. R., 45, p. 612).

The antiscorbutic vitamin, A. F. HESS (*Jour. Indus. and Engin. Chem.*, 13 (1921), No. 12, pp. 1115, 1116).—This is a brief summary of the known properties of vitamin C, particularly the effect of oxidation and of catalysis on the destruction of this vitamin. As an illustration of the effect of catalysis, experiments are cited in which milk was pasteurized at a temperature of 145° F. for 30 minutes, half of it being heated in a glass vessel and the other half in a copper vessel. As tested by feeding 80 cc. per capita of these two lots of milk to a series of guinea pigs, the milk heated in the copper vessel was found to have lost considerable of its antiscorbutic vitamin, while the milk heated in the glass vessel was apparently unaffected.

The destruction of the antiscorbutic vitamin in milk by the catalytic action of minute amounts of copper, A. F. HESS and L. J. UNGER (*Soc. Expt. Biol. and Med. Proc.*, 19 (1921), No. 3, pp. 119, 120).—Essentially noted above.

The quantitative determination of the antiscorbutic vitamin (vitamin C), H. C. SHERMAN, V. K. LAMER, and H. L. CAMPBELL (*Jour. Amer. Chem. Soc.*, 44 (1922), No. 1, pp. 165-172, fig. 1).—This and the following paper report in greater detail the study of vitamin C which has been noted previously from another source (*E. S. R.*, 45, p. 563).

In this paper the method employed is described, tables are given of the weight in grams at 3-day intervals of guinea pigs on the basal diet alone, and of protocols of the experimental animals on the basal diet alone or with the antiscorbutic, together with autopsy findings in regard to pathological changes in the bony system, and hemorrhages in the ribs, intestines, joints, and muscles. To add to the quantitative significance of the results obtained, the volume of the antiscorbutic (tomato juice) used in the various tests has been calculated to the amount fed per 300-gm. guinea pig. The severity of the autopsy findings is indicated in the table by — (no different from normal), ? (doubtful), tr (trace), and *, **, *** for increasing degrees of severity. It thus becomes possible to interpret symptoms and autopsy findings in terms of the percentage of the required amount of antiscorbutic which was actually received by the animal in any given case.

Judged by the standards presented, 3 cc. of canned tomato juice per 300-gm. guinea pig per day appears to furnish a fully adequate allowance of the antiscorbutic vitamin.

The effect of temperature and the concentration of hydrogen ions upon the rate of destruction of antiscorbutic vitamin (vitamin C), V. K. LAMER, H. L. CAMPBELL, and H. C. SHERMAN (*Jour. Amer. Chem. Soc.*, 44 (1922), No. 1, pp. 172-181, fig. 1).—In addition to the experimental data presented in the papers previously noted (see above), additional tests are reported in which guinea pigs were fed doses of 2, 3, and 4 cc. of tomato juice at H-ion concentrations of pH=4.3 and 8.3, through which oxygen in one series and hydrogen in another had been bubbled at atmospheric pressure while it was being heated at 100° C. for one hour.

Complete destruction of vitamin C resulted in both acid and alkaline preparations through which oxygen was bubbled, and greater destruction in the case of hydrogen than was obtained in the previous experiment, thus supporting the contention that the destruction of the vitamin in the experiments reported was due primarily to heat and not to atmospheric oxidation. "It is entirely possible that the heat destruction of vitamin C is of the nature of an intramolecular oxidation and reduction such as occurs when aldehydes or sugars are heated, especially in alkaline solution. The addition of external oxidizing or reducing agents then would serve to aid in the speed and completeness of the reaction."

The effect of temperature and hydrogen ion concentration upon the rate of destruction of the antiscorbutic vitamin, V. K. LAMER (*Diss., Columbia Univ., 1921, pp. 35, figs. 4*).—This is the complete report of the investigation noted in the above papers.

The rôle of microorganisms in the production of vitamins, E. WOLLMAN (*Compt. Rend. Soc. Biol. [Paris], 85 (1921), No. 31, pp. 801-803*).—The development of scurvy in guinea pigs on a ration of heated oats plus 200 cc. of sterilized milk inoculated 48 hours previously with *Bacillus bulgaricus* is thought to indicate that this microorganism does not possess the property of synthesizing vitamin C. Similarly the development of polyneuritis in pigeons on a diet of sterilized rice inoculated with *Amylomucor* is thought to indicate that this mold does not synthesize vitamin B.

The effect of the accessory substances of plant tissue upon growth of bacteria, O. T. AVERY and H. J. MORGAN (*Soc. Expt. Biol. and Med. Proc., 19 (1921), No. 3, pp. 113, 114*).—The observations of Thjötta and Avery that sterile potato tissue can replace blood in the cultivation of *Bacillus influenzae* (E. S. R., 46, p. 78) have been extended to other plant materials. Yellow and white turnip, carrot, beet, parsnip, and sweet potato have been found to possess the same growth-promoting property. In media containing such plant tissues the zone of H-ion concentration within which growth of bacteria is possible is said to be considerably extended on both the acid and alkaline side, and certain other bacteria which ordinarily fail to grow in an aerobic medium grow freely, although no precaution is taken to exclude the air.

“The exact nature of the substances contained in plant tissue upon which these properties depend is not yet determined, but the studies so far made suggest that they are related to the presence of certain oxidizing and reducing enzymes in fresh plant tissues as well as to the presence of so-called accessory food substances.”

Vitamin B (biocatalyzers) and coenzymes, I, H. VON EULER and A. PETTERSSON (*Hoppe-Seyler's Ztschr. Physiol. Chem., 114 (1921), No. 1-2, pp. 4-16, figs. 4*).—This paper reports a study of the effect of lemon juice, extract of wheat embryo, and extract of yeast on the fermentation of yeast as measured by carbon dioxid production and on the growth of yeast as measured by cell count.

The fermentation of the yeast was generally increased by the addition of these extracts, but the amount of carbon dioxid evolved was not proportional to the vitamin concentration, an excess of the extract having an inhibitory effect. An extract of yeast from which the protein had been removed by precipitation with alcohol showed proportionality between the amount of extract and increase in fermentation.

In general increased fermentation and cell growth did not parallel each other, sometimes an increase of 100 per cent in the fermentation being accompanied by only 10 per cent increase in the cell count. By altering the amount of vitamin preparation it was found possible to obtain a proportionality in the fermentation and cell growth.

Vitamin B (biocatalyzers) and coenzymes, II, H. VON EULER and K. MYRBÄCK (*Hoppe-Seyler's Ztschr. Physiol. Chem., 115 (1921), No. 3-4, pp. 155-169, fig. 1*).—Continuing the above study, the authors describe a method of determining the relative amounts of water-soluble vitamin (biocatalyzers) in different materials through the fermentation of yeast. In the nomenclature employed a distinction is made between the antineuritic and the growth-promoting vitamin B. For the former the name vitamin B is retained. The term biocatalyzer B is used to include biocatalyzer B I, the growth-promoting factor

of yeast; and biocatalyzers B II and B III, both of which influence fermentation. B III is considered identical with Harden's coenzym.

The solution used in the tests reported consists of 25 cc. of a 2 per cent phosphate solution of an H-ion concentration $\text{pH}=4.5$. In this are dissolved 2 gm. of sucrose and 1 gm. of finely pulverized dried yeast, and the solution is made up to 50 cc. with water or a solution of the material to be tested for vitamin activity. Fermentation is allowed to continue at a given temperature for 6 or 7 hours, and the amount of carbon dioxide evolved is measured at the end of given periods of time. Extracts of wheat embryo and blood serum tested in this way showed an increase in the amount of carbon dioxide evolved per hour up to a given concentration of the extract, after which there was a decrease, thus indicating the presence of an inhibiting factor in the extract as noted in the above paper.

To determine the amount of biocatalyzers II and III in any material, the amount necessary to add to the standard solution described in the above paper to bring about half the maximum fermentation is determined. From this the amount of vitamin biocatalyzer B II distinguished from the coenzym biocatalyzer B III can be determined by the method described by Tholin (E. S. R., 46, p. 309). The yeast used in the experiment should first be standardized to determine its fermenting power alone.

Data are reported on the vitamin B content of human blood serum, feces, and urine. These indicate a considerable daily excretion of vitamins.

On the function of the lymphocyte and of lymphoid tissue in nutrition, with special reference to the vitamin problem, W. CRAMER, A. H. DREW, and J. C. MOTTRAM (*Lancet [London]*, 1921, II, No. 24, pp. 1202-1208, figs. 7).—Atrophy of the lymphoid tissue of rats, particularly the thymus and spleen, and a diminution in the total number of lymphocytes in the circulating blood, attributed in an earlier paper to vitamin deficiency (E. S. R., 46, p. 62), are now further limited to a deficiency in vitamin B, evidence being presented that the absence of vitamin A does not lead to such characteristic changes. As a result of the observations reported the effect of vitamin B deficiency is explained as follows: "The lymphocyte has an important and specific function in maintaining the nutrition of the cells of the body, and the disturbances in nutrition which follow the withholding of B vitamin are secondary to a specific lesion which leads to an interference with the functional activity of the lymphoid tissues."

In discussing this conception, observations are reported which show that an ample supply of vitamins as compared with a supply merely adequate to enable the animals to grow at a restricted rate, breed, and maintain themselves in normal health, has a favorable effect on the functional activity of the lymphoid tissues, as shown by the lymphocyte count and weight of spleen and thymus, and on nutrition as evidenced by more rapid growth and gain in weight.

The similarity in results obtained by exposure to X-rays or radium and by diets lacking in B vitamin is considered a further proof of the relationship of the functional activity of the lymphoid tissues to vitamin B.

In discussing the nature of the function of the lymphoid tissue in nutrition, attention is called to the apparent paralysis of the intestinal tract following the withholding of vitamin B as evidence that the lymphocytes take part in the absorption of food from the intestines.

In conclusion, the authors emphasize again their belief that vitamins, especially vitamin B, are not necessary for the life of every individual cell. "This vitamin is necessary for the maintenance of life of a highly differentiated animal, not because its presence is necessary for the life of all the cells of

such an animal, but because its presence is necessary for the normal functioning of lymphoid tissue. In other words, the term 'deficiency diseases' is, like the term 'vitamin,' a misnomer. These diseases have their origin, like other diseases, in specific lesions. These lesions may be induced by different agencies of which a deficiency in vitamins is only one."

The effect of B vitamin on the appetite, S. WRIGHT (*Lancet [London]*, 1921, II, No. 24, pp. 1208, 1209, fig. 1).—Further evidence is presented that vitamin B has a favorable effect on the appetite as previously noted by various observers. In explanation of this effect the author advances the hypothesis that "vitamin B produces its effects by acting primarily, if not solely, on the intestinal canal. In its absence muscle tone is diminished, peristaltic movements are weak, and there is a reduction in the amount of digestive juice secreted. As a result, stasis occurs, the appetite flags, and the food intake falls off considerably. It is almost certain, however, that the animal is still consuming sufficient to enable it to survive for considerably longer periods than it actually does. The explanation for the early decline may perhaps be found in the changes which occur to the food which is retained for an abnormally long time in the intestine. Fermentation soon sets in and toxic bodies may be produced which adversely affect the general health of the animal, death resulting from the combined effects of all the factors mentioned."

The therapeutic possibilities of B vitamin (*Lancet [London]*, 1921, II, No. 24, p. 1228).—An editorial discussion based on the two papers noted above.

Observations on the influence of foods rich in accessory factors in stimulating development in backward children, H. CHICK and E. J. DALYELL (*Brit. Med. Jour.*, No. 3182 (1921), pp. 1061-1066, figs. 6).—A striking illustration of the influence of the simple addition of vitamins C and A to the diet of underweight, backward children is given in the report of such treatment, in a children's hospital in Vienna, of 9 children whose ages ranged from 12 to 31 months at the beginning of the treatment.

All of the subjects were under the normal weight for age and were markedly below the normal in general development. All but one had had one or more attacks of definite scurvy, and some symptoms of rickets were present in all cases. Since the children were born during the period of great food deprivation in Vienna (1918-19), it is thought probable that the mothers were imperfectly nourished during pregnancy and lactation. At the time of beginning the experiment the caloric value of the food was adequate, but the amount of milk fat was low and probably the vitamin C content of the milk was low on account of the necessity of heating the milk more than once before it was consumed. The energy value of the diet was not changed, but antiscorbutic material was given in the form of raw swede juice, 10 to 20 gm. daily, and vitamin A in the form of cod liver oil and butter, from 10 to 20 gm. of the former and about 10 gm. of the latter daily.

In all cases the result of these additions to the diet was satisfactory. The children began to put on weight more rapidly and to show rapid improvement in development and general activity. It is thought that both vitamins C and A were concerned in this beneficial effect. It is of interest that the normal standards were approached in some cases in from 6 to 12 months even after 24 months of retardation in growth and progress.

Vitamin deficiency and factors in metabolism relative to the development of rickets, A. HODGSON (*Lancet [London]*, 1921, II, No. 19, pp. 945-949).—To ascertain if possible the determining factor in the development of rickets, a study was made of the disease as observed in infant welfare clinics in Liverpool. A consideration of the diets of 120 cases showed that 64 had received

a good supply of vitamin A, 20 had had an inadequate vitamin supply, and of the remaining cases the diet was not sufficiently known to draw conclusions. Of the total number, 36 had a history of infectious diseases and 32 of other debilitating conditions.

The suggestion previously made by various workers of a lowered alkaline reserve in rickets was tested by comparison of the urines of healthy and rachitic children of the same age with respect to the proportion of ammonia nitrogen to total nitrogen and with respect to alkaline reserve as tested by the dosage of sodium bicarbonate required to change the reaction of the urine. In all, 65 children were thus examined, including 30 rachitic children (healed, active, or recovering), 25 healthy children, and 10 children suffering from other diseases than rickets.

In comparison with the controls, the rachitic children showed a high ammonia ratio and reduced alkaline reserve, and a less constant reduction of ammonia content following bicarbonate dosage. The author is of the opinion that there is sufficient indication of a lowering of the alkaline reserve in cases of active rickets for further work to be undertaken, particularly with respect to the alveolar CO₂ content.

Faulty food in relation to gastro-intestinal disorder, R. McCARRISON (*Jour. Amer. Med. Assoc.*, 78 (1922), No. 1, pp. 1-8, figs. 7; also in *Lancet* [London], 1922, I, No. 5, pp. 207-212).—In this lecture, delivered before the Society of Biological Research, University of Pittsburgh, on November 18, 1921, the author reviews and discusses much of his work which has been previously noted in the series of papers on deficiency disease (E. S. R., 43, p. 664).

Beriberi: A critical review, P. W. BASSETT-SMITH (*Trop. Diseases Bul.*, 18 (1921), No. 5, pp. 307-312, fig. 1).—This is a review of recent literature on the etiology, pathology, and treatment of beriberi.

The etiology of rickets, G. B. SWEET (*Brit. Med. Jour.*, No. 3182 (1921), pp. 1067, 1068).—The author gives a short description of rickets as it occurs in New Zealand. While advancing the theory that the disease is "primarily due to a diet actually deficient in fresh animal food, probably suitable protein, or to a disturbed digestive condition which prevents the assimilation of the same," it is emphasized that the course of rickets is not so severe in New Zealand as in Europe. In explanation of this the shortness of the winters and the abundance of sunshine are thought to play a part in the amelioration of the disease, thus pointing to the therapeutic effect of sunlight as noted by Hess and others.

The prevention of rickets in the rat by means of radiation with the mercury vapor quartz lamp, G. F. POWERS, E. A. PARK, P. G. SHIPLEY, E. V. MCCOLLUM, and N. SIMMONDS (*Soc. Expt. Biol. and Med. Proc.*, (1921), No. 3, pp. 120, 121).—It is reported briefly that the effects of the radiation of the mercury vapor quartz lamp on the growth and calcification of the skeleton of the rat and on the general physical vigor of the animal is similar to, if not identical with, the changes brought about by direct sunlight and by cod liver oil.

Malnutrition and its relation to tuberculosis, H. D. CHADWICK (*Amer. Rev. Tuberculosis*, 5 (1921), No. 8, pp. 674-677).—In a public school of 659 pupils, from kindergarten to the fourth grade, inclusive, 186 were found to be under weight; 146 of this group were examined and 48 found to be definitely tuberculous. It is considered of significance that the percentage of tuberculous children in the whole school coincides closely with the present death rate from tuberculosis, about 7 per cent. The author is of the opinion that antituberculosis activities should be directed more and more toward child welfare, and that this can best be accomplished by the establishment of nutrition clinics in the schools.

The action of ultraviolet light on metabolism, W. LASCH (*Deut. Med. Wchnschr.*, 47 (1921), No. 36, p. 1063).—Data are presented on the calcium balance of three rachitic infants before, during, and after ultraviolet light treatment according to the usual methods. In all three cases there was a marked increase in calcium and also in phosphorus retention after about six treatments. The increase continued after the clinical symptoms of the disease had disappeared until values considerably above the normal were obtained. The prompt response to treatment is thought to indicate that the rachitic process is of the nature of a derangement of the intermediary metabolism of calcium and phosphorus.

Therapeutic application of *Bacillus acidophilus*, L. F. RETTGER and H. A. CHEPLIN (*Soc. Expt. Biol. and Med. Proc.*, 19 (1921), No. 2, pp. 72-76).—A brief report is given of the results obtained in the therapeutic application of *B. acidophilus* in milk culture (E. S. R., 45, p. 65) in cases of chronic constipation, chronic diarrhea following an attack of bacillary dysentery, colitis, sprue, and dermatitis (eczema). In commenting upon the favorable results generally obtained, the authors emphasize that the ingestion of relatively small numbers of the bacilli can not be expected to lead to implantation and bodily improvement, that the viability of the organism must be preserved in its preparation for therapeutic purposes, and, finally, that *B. acidophilus* is not a panacea for all ills.

The physiological cost (expenditure of CO₂) in walking on a rolling surface and on a level surface, A. D. WALLER and G. DE DECKER (*Compt. Rend. Soc. Biol. [Paris]*, 84 (1921), No. 18, pp. 910-912, fig. 1).—Using methods employed in their previous studies (E. S. R., 46, p. 571), the authors report two observations of the carbon dioxid output of one subject during 50 minutes' walk on a rolling surface and two of the same subject walking on a level race track. The former work was accomplished at a cost of from 14.4 to 18.9 cc. of CO₂ per second when the speed of walking was 1.45 meters per second and at a cost of from 13 to 31.2 cc. of CO₂ when the speed was 1.87 meters per second. The results obtained in walking on level ground were from 13.8 to 16 in the first period when the speed was 1.67 meters per second and from 13.2 to 26.3 in the latter when the speed was increased to 1.92 meters per second. The average amount of CO₂ per kilogram of body weight for the four periods in the order named were 0.19, 0.2, 0.15, and 0.175 cc. of carbon dioxid, respectively.

ANIMAL PRODUCTION.

The relative growth-promoting value of the protein of coconut oil meal and of combinations of it with protein from various other feeding stuffs, L. A. MAYNARD and F. M. FRONDA (*New York Cornell Sta. Mem.* 50 (1921), pp. 621-633, figs. 4).—This is a report of feeding experiments with white rats to study the quality of the proteins of coconut oil meal as compared with proteins of various other feeding stuffs. Three rats were used in each lot. The tests ran for 13 weeks, but the averages reported are for the last 12 weeks. The rations were made up by using the feeding stuff or combination to be tested as the sole source of protein. The diet was otherwise made adequate by supplying minerals and vitamins and adding starch where necessary to bring up the total energy. The ration was so chosen as to make the total protein eaten insufficient for normal growth even though fed ad libitum.

Growth curves of each rat in each lot are included, as well as normal growth curves for ease of comparison. Tables are given showing the average gains, food intake, and gains per gram of food and protein eaten according to the first

week and by periods of 4 weeks thereafter. A summary of these results is given in the following table:

Summary of source of protein, average food intake, and gains per rat during 12 weeks.

Source of protein.	Amount of protein in feed.	Average gain per rat.	Total intake per rat.		Gain per gram.	
			Food.	Protein.	Food.	Protein.
	<i>Per cent.</i>	<i>Grams.</i>	<i>Grams.</i>	<i>Grams.</i>	<i>Grams.</i>	<i>Grams.</i>
Corn meal.....	8.93	111.9± 4.2	1,678	149.85	0.067	0.75
Coconut oil meal.....	8.99	132.5± 7.6	1,302	117.04	.102	1.13
Corn meal and coconut oil meal (3 : 1).....	8.93	115.9± 4.7	1,610	143.85	.072	.81
Corn meal and skim milk (3 : 1).....	8.93	180.8± 1.7	1,560	139.29	.116	1.30
Coconut oil meal and rice bran (3 : 1).....	8.99	177.2± 11.5	1,430	131.26	.121	1.35
Coconut oil meal and wheat middlings (3 : 1).....	8.99	158.7± 5.7	1,342	120.67	.118	1.32
Coconut oil meal and kafir (3 : 1).....	8.99	148.6± 12.5	1,494	134.31	.099	1.11
Coconut oil meal and alfalfa leaf meal (3 : 1).....	8.99	118.3± 4.5	1,195	107.45	.099	1.10
Coconut oil meal and alfalfa meal (3 : 1).....	8.99	152.2	1,668	149.95	.091	1.02
Coconut oil meal and rice bran (3 : 1).....	14.84	199.3± 13.6	1,493	221.56	.133	.90

The conclusion is that the protein of coconut oil meal is of higher quality than that of corn meal, and it was found equal to corn meal and skim milk for promoting growth when supplemented with 25 per cent of rice bran or wheat middlings protein on a 9 per cent protein intake plane. The trials in which alfalfa products were used as supplements were rather unsatisfactory, due to the low palatability of the rations. Adding corn or kafir to coconut oil meal resulted in very little or no addition to the quality of the protein.

The digestibility of oat and tare silage, T. B. WOOD and H. E. WOODMAN (*Jour. Agr. Sci. [England]*, 11 (1921), No. 3, pp. 304-309).—This is a report of a digestion experiment with two wethers for two feeding periods of 14 days each. During one period a basal ration was fed which consisted of 500 gm. of meadow hay and 100 gm. of linseed cake. During the other period 1,000 gm. of oat and tare silage was added to the basal ration. The digestion coefficients of the oat and tare silage for the two sheep were as follows: Total dry matter 55 and 55.54 per cent, crude protein 66.19 and 68.15 per cent, ether extract 75.50 and 82.31 per cent, nitrogen-free extract 53.49 and 50.85 per cent, crude fiber 48.9 and 50.57 per cent, and ash 49.7 and 50.63 per cent.

The quality of silage produced in barrels, R. NEWTON (*West. Canad. Soc. Agron. Proc.*, 1 (1920), No. 1, pp. 116-128).—This is the report of an experiment to determine the possibilities of keeping silage in barrels for experimental purposes. Corn, sunflower, oat, and buckwheat silage were kept in oil barrels from September 5 to June 2. The silage was tamped in the barrels with a fence post. On opening the quality of the silage, judged by appearance, odor, palatability, and chemical tests, seemed to be normal.

Official and special feeding stuff analyses, 1920, E. P. GREENE (*Fla. Dept. Agr. Quart. Bul.*, 31 (1921), No. 1, pp. 84-100).—Analyses of 17 samples of feeding stuffs sent in by purchasers are reported together with the guaranteed and found analysis of 127 samples taken by the State inspectors. The materials analyzed included cottonseed meal, wheat middlings (with and without screenings), dried beet pulp, wheat mixed feed, wheat bran with screenings, peanut feed, cottonseed feed, and corn and gluten feed.

Science of nutrition as a guide in practical feeding, E. B. MEIGS (*Hoard's Dairyman*, 63 (1922), No. 3, pp. 67, 93, 94, fig. 1).

The influence of lactation on the sexual cycle in the rat and guinea pig, L. LOEB and C. KURAMITSU (*Amer. Jour. Physiol.*, 55 (1921), No. 3, pp. 443-

449).—The authors have made examinations of the ovaries of rats and guinea pigs which they killed from 10 hours to 5 weeks after parturition. Some of the animals were allowed to suckle their young, whereas the others had their young removed at birth. The examinations seemed to indicate that ovulation is suspended during the period of nursing in the rat, whereas it is continued during nursing in the guinea pig.

Robert Bakewell: What agriculturists owe to him to-day (*Live Stock Jour.* [London], 95 (1922), No. 2497, pp. 127, 128, fig. 1).—This article deals with the accomplishments of Robert Bakewell, bringing out the service he rendered in developing Longhorn cattle, Shire horses, and Leicester sheep.

Proceedings of the twenty-fourth annual convention of the American National Live Stock Association (*Amer. Natl. Live Stock Assoc. Proc.*, 24 (1921), pp. 222, pls. 7).—This is the report of the annual meeting of this association held at El Paso, Tex., and contains a number of addresses of interest to the stockman, as well as reports of committees, resolutions adopted, and other routine business.

[Live stock industry in Canada], S. F. TOLMIE (*Canada Min. Agr. Rpt.*, 1920, pp. 29-40).—This is a report of the horse and cattle breeding operations in Canada during the year ended March 31, 1920, including the progress which has been effected by the aid of the Department of Agriculture. The year's progress in testing dairy cattle for milk and fat production, as well as the supervision of poultry rearing and marketing, is reported. The poultry entered for performance records are listed according to the breed and the Province where they are located.

Grading up farm cattle, I. KIRKWOOD (*Kans. State Bd. Agr., Bien. Rpt.*, 22 (1919-20), pp. 77-89, figs. 7).—The author relates the story of how W. R. Nelson started the cattle breeding at Sni-a-Bar Farms by selecting a lot of grade cows and a good purebred Shorthorn bull. The results of the crosses are reported, as well as some of the winnings at the live-stock shows. This is given as an example of what may be done with a purebred sire of good quality.

On the relative growth and development of various breeds and crosses of cattle, J. HAMMOND (*Jour. Agr. Sci. [England]*, 10 (1920), No. 3, pp. 233-289).—The data furnished in this article are mainly taken from the animals shown at the Smithfield Live-Stock Show from 1895 to 1913.

The average weights of the animals of each breed and age are given for heifers and steers in three periods of seven years each, as well as the average for the entire time. The weight of the animal (live), carcass, suet fat, gut fat, tongue, head, heart, tripe, hide, blood, and intestine for heifers and steers of each breed is given for animals in the carcass classes, as well as the percentage weight of the different organs and tissues for heifers and steers of each breed. The comparative live weights and carcass weights of crossbred heifers and steers that were shown are also presented in tables according to their breeding. The correlation between the weights of the various organs and tissues for the animals of the carcass classes is also indicated in a table. The growth which was reported during the different seasons is recorded by years for three breeds and the average for all breeds, as well as notes on certain other more or less climatic conditions for each year.

Identical twins in cattle? J. W. GOWEN (*Biol. Bul. Mar. Lab. Woods Hole*, 42 (1922), No. 1, pp. 1-6).—The author furnishes the following sources of evidence to indicate that identical twins rarely if ever occur in cattle: (1) In summarizing data furnished by Lillie (E. S. R., 40, p. 466), Cole (E. S. R., 35, p. 169), and from the Maine Experiment Station, it was found that the ratio of male, male and female, and female twins approached 1:2:1; (2)

data taken from the American Guernsey Herd Book showed that 56.52 per cent of male and female twins, 57.36 per cent of sisters, 59.95 per cent of female twins, and 61.31 per cent of male twins were alike in color markings; (3) in the armadillo, where quadruplets developed from one egg, there is almost absolute similarity of color markings.

If identical twins occur so seldom in cattle as the evidence seems to indicate, the theory that the freemartin is an undifferentiated male formed by the division of a single male-producing egg becomes doubtful.

Cattle feeding experiments, W. G. R. PATERSON (*Highland and Agr. Soc. Scot. Trans.*, 5. ser., 32 (1920), pp. 35-55; also in *West of Scot. Agr. Col. Bul.* 97 (1921), pp. 91-114).—The results of four experiments, carried out at Crichton Farm, Dumfries, and on the West of Scotland Agricultural College Farm, Kilmarnoch, are reported as follows:

I. *Gains of cattle receiving concentrates against cattle receiving a moderate amount of concentrates.*—Three groups of cattle were selected, composed of 4 Aberdeen-Angus and 2 Red Polled crosses each. The following rations were fed per head per day: Group 1, 72 lbs. of rutabagas, straw and water ad libitum; group 2, 6 lbs. of hay (rye grass and clover hay), 72 lbs. of rutabagas, and straw and water ad libitum; group 3, 3 lbs. (increased to 4 lbs. at end of sixth week) concentrates (crushed oats and decorticated cotton cake, equal parts), 6 lbs. of hay (rye grass and clover hay), 72 lbs. of rutabagas, and straw and water ad libitum. At the end of 13 weeks the respective average gains per week were 10.9, 14.4, and 19.8 lbs. The condition of the flesh of group 1 was not so good as group 2, nor was group 2 in as good condition as group 3.

II. *Suitability of fish meal for fattening cattle.*—Three groups of 3 animals each were fed exactly as in the previous experiment, and a fourth group of 6 animals was fed the same as group 3 except that the concentrates were composed of 1 lb. of fish meal and 2 lbs. of crushed oats. Groups 1, 2, and 3 were on test 12 weeks with average weekly gains per head of 8.4, 11, and 17.6 lbs., respectively. Group 4 was on test 8 weeks and averaged 18.2 lbs. gain per week. The fish meal was not eaten well at first, but the cattle soon relished it and did well on it.

III. *The value of fish meal for beef production.*—Two groups of Shorthorn crosses of 6 animals each were selected. One group received decorticated peanut cake in the ration, whereas the other group received fish meal. The average weekly gains of the peanut cake lot were 14.7 lbs. and for the fish meal lot 15.1 lbs.

IV. *Further tests of fish meal for beef production.*—Two groups of 10 Shorthorn-Galloway crosses were selected for this test, which lasted 110 days. The one group received decorticated cotton cake in the ration, whereas the other received fish meal. Both rations contained the same total amount of protein. The average weekly gains per head were 15.3 lbs. for the cotton cake group and 15.6 lbs. for the fish meal group. The fish meal carcasses were inspected and showed no bad effects from the fish meal. From these results fish meal in the amounts fed seemed fully equal to decorticated cotton cake or peanut cake for the production of beef.

The wool industry, B. G. L. ENSLIN (*Union So. Africa Dept. Agr. Bul.* 4 (1920), pp. 60).—This is the report by the chief of the division of sheep and wool of the Department of Agriculture of the Union of South Africa after an investigation of the wool industries of Great Britain and the United States. It deals with the grades and quality of wool and the methods of marketing in the principal wool-producing countries. The defects of South African wool

and how they may be remedied are discussed, as well as suggestions for improvement in marketing conditions in South Africa.

The British Goat Society's Yearbook for 1921, compiled by T. W. PALMER (*Brit. Goat Soc. Yearbook, 1921, pp. 17-111, pls. 26*).—This publication is composed of 28 articles on goat breeding, management and diseases, herd book registry, breeds of goats, milk records, and the analysis of goat milk, together with the rules and regulations and lists of members of the British Goat Society.

Winter rations for brood sows, A. A. DOWELL (*Alberta Univ., Col. Agr. Circ. 1 [1920], pp. 14*).—The author gives an account of experiments carried on during 1917-18 to determine the effect of certain rations and conditions on the production of hairless pigs. Twelve lots of 3 sows each were used, including purebred Berkshires, Tamworths, and Duroc-Jerseys. The following conclusions were drawn:

The sows fed on frozen wheat or barley alone produced many weak and hairless pigs, whereas adding 10 per cent tankage to either ration seemed to produce normal pigs. Whole oats alone resulted in slow gains in the sows, but the pigs were normal. More hairless pigs seemed to result in early litters than in late ones. Sunlight and exercise seemed to have no effect on the production of hairless pigs. It was also doubtful whether eating snow instead of water had any effect. The supplying of minerals in the form of fine coal was found beneficial.

The effect of feeding skim-milk powder to weanling pigs, W. A. WENDT (*Hawaii Univ. Quart. Bul., 1 (1922), No. 2, pp. 33-40*).—The results of feeding skim-milk powder to three Tamworth pigs are reported. Three litter mates were used as checks in this test. Two lbs. of skim milk (made from skim-milk powder) per head per day were fed to the first lot along with grain and alfalfa, whereas the second lot received the same ration without skim milk but with the occasional addition of tankage. The lot getting skim milk gained 1.8 lbs. per head per day at a cost of 22.4 cts. per pound, as compared with 2.04 lbs. and 18.6 cts. for the check lot.

Garbage feeding in relation to the control of hog cholera, F. TORRANCE (*Jour. Amer. Vet. Med. Assoc., 60 (1921), No. 1, pp. 22-25*).—The veterinary director general of Canada explains the rules which have been in effect since 1915 for feeding garbage to hogs in Canada. According to these rules, any one feeding garbage agrees to have it thoroughly cooked and to notify the veterinary inspector immediately if any sickness appears among the hogs. By doing this the number of outbreaks of cholera have been greatly reduced.

Hogging-down experiments (*Kentucky Sta. Rpt. 1920, pt. 1, pp. 34, 35*).—This is a continuation of the work of the previous year (*E. S. R., 43, p. 871*).

Hogging down of corn alone produced 401 lbs. of pork at a net profit of \$28.72 per acre. Hogging down corn with access to a self-feeder of tankage, hogging down corn and soy beans grown together, hogging down soy beans and feeding hogs 2.5 per cent of their body weight in corn per day, and hogging down soy beans and feeding corn in a self-feeder produced 535, 347, 846, and 1,114 lbs. of pork per acre, respectively, at a profit of \$36.05, \$19.41, \$16.72, and \$6.01 per acre. The last two experiments produced soft pork.

Wampee, L. CARRIER (*U. S. Dept. Agr., Bur. Plant Indus., 1921, pp. 2*).—Wampee hog pasture is said to offer a means for utilizing the marshes and tidal flats of the South Atlantic and Gulf coasts, some of which were once used for rice but now are practically worthless for agriculture. The term wampee, of Indian origin, includes several fleshy rooted swamp plants, among which are the arrowheads, especially *Sagittaria latifolia*, the arrow arum (*Peltandra virginica*), and the pickerelweed (*Pontederia cordata*). The tubers from these

plants vary greatly in shape and size, depending upon the species producing them.

The experience gained on a plantation near Mays, Ga., indicates that the returns made by hogs from grazing wampee will give a profit even on several times the present valuation of such lands. Analysis of the tubers shows a high starch content comparable with potatoes, and taken together with other food substances found in the swamps the wampees furnish a fairly well-balanced ration.

Comparative osteology of the horse and the ass.—**Zootechnics of the asinine race of Catalonia**, M. ROSSELL I VILÀ (*Catalunya [Spain] Dept. Agr., Arx. Escola Super. Agr. No. 1, (1921), pp. 54+16, pls. 24*).—This work consists of two parts. Part 1 deals with the description of the individual bones of the horse and the ass, with the differences carefully noted. Part 2 consists of a description of the Catalanian ass, together with the methods of breeding and improvement which have been employed. The great value of Catalanian jacks for mule production is also brought out.

Standard poultry for exhibition, J. H. ROBINSON (*Quincy, Ill.: Rel. Poultry Jour. Pub. Co., 1921, pp. 176, pl. 1, figs. 527*).—This publication deals with the general care, selection, and fitting of poultry for exhibition, as well as giving the fundamental principles of judging and handling poultry for showing. The work is profusely illustrated with pictures of prize-winning poultry, poultry houses, equipment for exhibition birds, and well-known judges and poultrymen. A history of poultry shows is given from the point of view of the service which they have rendered to the poultry industry.

Report on the poultry industry in the Netherlands, E. BROWN (*London: John Bale, Sons & Danielsson, Ltd., 1921, pp. VI+117, pls. 16*).—A discussion is given of the poultry industry in the Netherlands as observed by the author after visits to farms, breeding establishments, markets, cooperative societies, and conferences with traders and officials. The country is described, together with the poultry farming practiced in each part, the breeds kept, the eggs produced, and the methods of marketing practiced, as well as State assistance offered for poultry investigation and teaching.

Experimental work with poultry (*Kentucky Sta. Rpt. 1920, pt. 1, pp. 35-37*).—In a continuation of the work on the source of protein (E. S. R., 43, p. 871), the results were in substantial agreement with the previous report. Pullets averaging 22.7 eggs on cottonseed meal produced an average of 106.5 eggs on tankage the next year. Pullets averaging 103 eggs on tankage produced an average of 32.7 eggs when fed the cottonseed meal ration as yearlings. The lack of animal protein is concluded to be the cause of the low production record of pullets being fed on cottonseed meal.

Two years' results indicate a marked increase of eggs during the winter months for both hens and the pullets by the use of electric lights. However, the yearly production of hens not under light was slightly greater than for those under the light. The light increases production at the season when eggs are the highest in price.

Two years' work with White Wyandottes to determine the most efficient percentage of meat scrap to use in a ration has shown that the average annual production of eggs per hen in 1918-19 was 116, 142, 149, and 158 eggs, respectively, with 5, 10, 15, and 20 per cent of meat in the mash. For 1919-20, the corresponding production was 120.5, 127, 138, and 148 eggs.

Importance of animal protein in rations for laying hens, A. G. PHILIPS (*Rel. Poultry Jour., 28 (1922), No. 12, pp. 1151, 1197-1199, fig. 1*).—In this article the author deals with the more common sources of protein for poultry feeding and cites the results of 11 years of experimental work at Purdue Uni-

versity in which different forms of protein were fed to laying hens. In nearly all cases where meat scrap, tankage, fish scrap, skim milk, and dried or liquid buttermilk were fed in the ration the egg production was over twice that of hens receiving no animal protein.

Effect of calcium on the composition of the eggs and carcass of laying hens, G. D. BUCKNER and J. H. MARTIN (*Jour. Biol. Chem.*, 41 (1920), No. 2, pp. 195-203).—This is the report of a six months' experiment carried on to determine the effect on the eggs and hens of a ration lacking sufficient calcium. Four lots of 10 White Leghorn pullets had their regular ration supplemented as follows: Lot 1 no supplement, lot 2 grit, lot 3 grit and oyster shells, and lot 4 grit and limestone.

Analysis of the femur and tibia and of the carcass of a normal bird was made for total ash, CaO, MgO, and P₂O₅. A normal egg and eggshell were also analyzed for the same substances. From time to time eggs and eggshells were analyzed from different lots, as well as the carcass of one bird from lot 2 which broke down during the test. Final analyses were made of one average carcass and the femurs and tibias from one bird from each lot at the close of the six months' test. During the test there was little difference in the percentage of CaO, MgO, or P₂O₅ in the eggs or shells of the different lots. However, there was a tendency for the total amount of the elements to be lessened in the shells, so that the shells from lots 1 and 2 got very thin. The total ash in the bones of lots 1 and 2 was much less than that in lots 3 and 4, but the percentages of the substances in the ash were practically the same.

Establishing type and egg size, J. J. JORDAAN (*Natl. Poultry Jour.*, 2 (1922), No. 92, p. 539).—An experiment was carried on from May 1, 1915, to March 31, 1921, at the Glen School of Agriculture, South Africa, for building up laying strains of Speckled Sussex, White Wyandottes, and Silver Campines, with White Leghorns and Light Sussex added to the experiment later. The pens were inbred to fix uniformity in all characters. Considerable improvement was obtained, both in egg production and egg size until the year 1919-20, when there was a distinct drop in production, due possibly to too much inbreeding, stale ground in the pens, or lack of rigorous selection.

A system of pedigree work, B. GLENDINING (*Natl. Poultry Jour.*, 2 (1922), No. 86, pp. 447-449, figs. 7).—This is the report of a system of carrying on pedigree work with poultry whereby the eggs from each hen are placed in special wire cages on the eighteenth day of incubation. The chicks are numbered with leg bands at hatching time, and at from 3 to 5 weeks of age wing numbers are inserted. Suggestions are offered for ease and accuracy of keeping pedigree records of the birds.

The genetics of egg production in White Leghorns and White Wyandottes, I-XII, C. C. HURST (*Natl. Poultry Jour.*, 2 (1921), Nos. 65, pp. 148, 149; 66, p. 162; 67, pp. 178, 179; 68, pp. 190, 191; 69, pp. 205, 206; 70, pp. 219, 220; 71, pp. 235, 236; 72, pp. 251, 252; 75, pp. 293, 294, 295; 76, pp. 306, 307; 77, pp. 320, 321, 322; 79, pp. 348, 349).—In a series of 12 articles the author reports the results of an experiment carried on to determine the factors affecting egg production in White Leghorns and White Wyandottes. A total of 430 pullets of three strains of each breed were used. Over 50,000 eggs were recorded and graded for size and color in the course of the experiment. The following seven unit characters were found to affect egg production: Rate of sexual maturity (date of first laying), rate of winter egg production (eggs produced to March 1), rate of spring production (March 1 to July 1), rate of autumn egg production (July 1 to end of laying year), broodiness (number of times broody during first year), modal egg size, and modal egg color.

None of these factors seemed to be sex-linked, nor did zero egg production seem to depend on the double recessive L_2 factor as reported by Pearl in Plymouth Rocks. The following table giving a summary of the results obtained as compared with the theoretical shows the symbols used by the author and the dominant and recessive characters:

Summary of results with White Leghorns and White Wyandottes.

Character contrast.	Symbol and dominant character.	Symbol and recessive character.	Theoretical results.		Observed results.	
			Dominant.	Recessive.	Dominant.	Recessive.
Sexual maturity.....	E early.....	e late.....	289	46	286	49
Rate of winter egg production.....	W fast.....	w slow.....	231.75	35.25	231	35
Rate of spring egg production.....	S fast.....	s slow.....	217.25	6.75	216	8
Rate of autumn egg production.....	M slow.....	m fast.....	145.50	48.50	140	54
Broodiness.....	H broody.....	h nonbroody.....	58.50	142.50	50	151
Modal egg size.....	N small.....	n large.....	128.75	202.25	135	196
Modal egg color.....	C brown.....	c white.....	142	189	137	194

The theoretical results were calculated from the genetic constitutions of the sires and dams according to Mendelian proportions, and the actual results seemed to agree very closely with the calculated. The genetic constitutions of the sires and dams were determined by the characters observed on the individual, such as early maturity, etc., by the characters of their parents, and by the number and characters of their offspring.

In his conclusion, the author suggests that winter egg production is really determined by two factors, E and W. Dominant E produces birds which start laying early and W produces a high rate of laying. Spring and autumn productions are determined by one factor each except as the factor H (broodiness) affects the production at any time of the year. The size of the eggs are controlled by one factor N, the recessive producing large eggs. Egg color is controlled by one factor which is not concerned with the production, but is important because of market preferences for certain colored eggs. The possibility of incomplete dominance of some of the characters in case of mediocre performers is also mentioned.

Report of egg-laying contests for 1921, R. R. HANNAS (*New Jersey Stas. Hints to Poultrymen*, 10 (1922), No. 5, pp. 4).—This is a preliminary report of the second year of the Vineland (E. S. R., 43, p. 173) and the first year of the Bergen County international egg-laying and breeding contests.

The average yearly production for all 2,000 pullets entered at the Bergen County contest was 134.7 eggs. The average yearly production of the 1,200 yearlings entered at the Vineland contest was 138.7 eggs. At the Bergen County contest 112 pullets laid over 200 eggs each and, therefore, qualified for registry in the American Record of Performance Council. At the Vineland contest 234 yearlings laid over 180 eggs and qualified for registry.

A record of the food consumption of the different breeds and the estimated profit is presented for each test, as well as a table showing the cause of death of the birds dying during the contests.

The preservation of eggs, including a bibliography of the subject, H. I. JONES and R. DuBORS (*Jour. Indus. and Engin. Chem.*, 12 (1920), No. 8, pp. 751-757).—This article, which includes a long bibliography, briefly explains the various methods which have been used for preserving eggs, such as cold storage, packing in air-tight substances, coating with impervious agents, and storing in solutions.

In experiments performed with water glass, paraffin, vaseline, egg white, and a gasoline solution of aluminum soap, the last-named substance was found to give by far the best results. It was found necessary to treat the eggs with H_2SO_4 , however, to prevent the absorption of the gasoline flavor. It was also found that pentane could be used as a solvent for the aluminum soap without injuring the flavor of the eggs.

DAIRY FARMING—DAIRYING.

Which kind of silage shall we produce? W. H. HICKS (*Farmer's Advocate*, 56 (1921), No. 1490, pp. 523-525 fig. 1).—In comparisons made with corn, clover, oat and pea, and sunflower silages at the Agassiz Experimental Farm, Canada, from 1915 to 1919, the cheapest milk seemed to be produced with corn silage, but the adaptability to various conditions of each kind of silage is mentioned.

Milk secretion as related to diet, E. B. MEIGS (*Physiol. Rev.*, 2 (1922), No. 2, pp. 204-237).—This is a review of the literature on this subject, of which a bibliography of 105 references is included.

The origin of milk fat and its relation to the metabolism of phosphorus, E. J. SHEEHY (*Biochem. Jour.*, 15 (1921), No. 6, pp. 703-709, fig. 1).—This is the report of an experiment carried on at Albert Agricultural College, Dublin, to see if fatty feeds would tend to produce a higher fat percentage in the milk. The fat and milk from a cow on a normal ration were recorded for 7 days, after which the cow was fasted 18 hours and then fed a ration high in fat (linseed oil). On the tenth day she was again fasted 18 hours and fed a ration high in carbohydrates (molasses). The results showed practically no change in the fat content of the milk in either case. Similar experiments on more cows gave the same results.

Analyses were then made of milk from 6 cows for successive days as to fat, caseinogen, and total and inorganic phosphoric acid. The author concludes from these experiments that, in the formation of milk, soluble phosphatids diffuse from the circulating blood into the gland cells and are disintegrated into fat, phosphorus, etc. The fat, being nondiffusible, remains in the glands, whereas part of the phosphorus diffuses back into the blood. The immediate source in the blood of milk fat is concluded to be phosphatids.

Dairy cattle, L. A. HENKE (*Hawaii Univ. Quart. Bul.*, 1 (1922), No. 2, pp. 20-27).—In presenting a report of dairy cattle operations at the University of Hawaii, the yearly milk and fat production of the cows from 1912 to 1921 is given, as well as a record of each cow as to date of birth, cost of feed, and monthly weights from July 1, 1920, to June 30, 1921.

A study in community cattle breeding, J. H. SHEPPERD (*Soc. Prom. Agr. Sci. Proc.*, 39 (1919), pp. 61-68).—A cooperative dairy cattle breeding enterprise carried on near New Salem, N. Dak., under the joint supervision of the U. S. Department of Agriculture, the North Dakota Experiment Station, and the New Salem Holstein-Friesian Cattle Breeders' Association from 1905 to 1917 is described.

Registering cattle in Friesland, D. D. OFFRINGA (*Hoard's Dairyman*, 63 (1922), No. 11, p. 392, figs. 4).—A description of the methods of registering Friesian cattle in Friesland is reported. A calf herdbook serves as a preliminary step in registering animals. Before registering the animal in the regular herdbook, heifers must be 2 years and 10 months of age and bulls 13 months of age, and they must be inspected and recommended by special judges for the association who not only score them but make several measurements on the animals, with notes of their description and markings.

Why preliminary milking pays in advanced registry tests, S. W. MEAD (*N. J. Agr.*, 4 (1922), No. 2, pp. 12, 13, fig. 1).—An experiment is reported which was carried on with four cows at the New Jersey Experiment Stations to determine the necessity of seeing that cows were milked dry before starting an advanced registry test. Leaving part of the milk in the udder was found to increase the milk an average of 0.27 per cent during the next four milkings.

The value of food records in connection with milk recording societies, G. H. GARRAD (*Jour. Min. Agr. [London]*, 28 (1922), No. 11, pp. 988-995).—This article shows how feeding records along with milk records of cows are of a distinct advantage to the farmers belonging to milk-recording societies. By going over the feed records the agricultural organizer has been able to suggest changes which have saved the farmers money and better prepared them to make a more economic choice of their cattle-feeding stuffs.

The milk problem in hot climates, R. J. BLACKHAM (*Jour. Roy. Sanit. Inst.*, 42 (1922), No. 4, pp. 222-226).—The author gives the composition of milk in India as previously reported (*E. S. R.*, 27, p. 473). The difficulties of obtaining good wholesome fresh milk in the Tropics and the advantages of dried milk for tropical use are brought out. Some good results which have been obtained with dried milk in the case of dysentery, tuberculosis, diarrhea, typhoid fever, etc., are listed.

A plea for a more vigorous supervision of the cowshed.—The duties and powers of the sanitary officers in relation thereto, C. E. GODDARD (*Jour. Roy. Sanit. Inst.*, 42 (1922), No. 4, pp. 227-230).—The conditions of milking at many of the dairies in England are stated as being entirely unsatisfactory. It is recommended that dairymen be advised and warned as to the methods of sanitary milk production, and that if they do not heed the advice they should be prosecuted.

Milk and disease, S. G. MOORE (*Jour. Roy. Sanit. Inst.*, 42 (1922), No. 4, pp. 219-221, 244).—The author reviews the unsanitary methods which are often employed in the production of milk in England, 179 epidemics of scarlet fever, diphtheria, and typhoid fever having been definitely traced to milk. He cites the more stringent requirements which are in effect in the larger cities of the United States, and advocates that a resolution for providing a safe milk supply for England be adopted by the Council of the Royal Sanitary Institute.

Modern milk goats, I. RICHARDS (*Philadelphia and London: J. B. Lippincott Co.*, 1921, pp. XII+271, pl. 1, figs. 76).—This is a general textbook on milch goat production, discussing their care, management, feeding, and breeding. Suggestions are given for judging goats, as well as descriptions and standards for the different breeds.

The Grove City Creamery, S. C. THOMPSON (*N. Y. Prod. Rev. and Amer. Creamery*, 53 (1922), No. 17, pp. 798-800, 802, 804, 805).

Yield of cheese, J. L. SAMMIS (*N. Y. Prod. Rev. and Amer. Creamery*, 53 (1922), No. 17, pp. 821-826).—Due to the inaccuracy of methods to determine the yield and quality of cheese from milk, three years' experiments carried on at the Wisconsin Experiment Station to determine the yield and the difference in composition of cheese from high and low testing milk are reported. In these tests Jersey and Holstein milk were used for high and low fat content. The milk was produced on the University Farm under the same conditions and handled in the same manner.

The average results indicated that 1 per cent difference in fat equaled 1.77 lbs. difference in cheese yields. Cheese made from 4.5 per cent milk was found to have 2.5 per cent higher food value than cheese made from 3.5 per cent milk. Suggested methods for calculating the actual cheese yields of different milks are stated.

Sandy ice cream, O. E. WILLIAMS (*N. Y. Prod. Rev. and Amer. Creamery*, 53 (1922), No. 18, pp. 878, 880-884).—The author cites several experiments in the production of sandiness in ice cream. The three conditions frequently found to be a cause of the sandy condition were: (1) sandy condensed or evaporated milk, (2) excessive lactose in the mix, and (3) fluctuation of the temperature in the hardening room. The sandiness which occurred was found to be due to crystals of lactose and not to sucrose crystals.

VETERINARY MEDICINE.

Diagnostic methods, R. W. WEBSTER (*Philadelphia: P. Blakiston's Son & Co.*, 1920, 6. ed., rev. and enl., pp. XXXIX+844, pls. 37, figs. 170).—In the sixth revision of this volume, an earlier edition of which has been noted (E. S. R., 27, p. 284), several new methods have been added, among which may be noted the Folin and Denis method for the determination of lactose in milk, Folin and Wu's system of blood analysis, and electrometric methods for determining H-ion concentration.

Immunity, protective vaccination, and serum therapy, A. DIEUDONNÉ and W. WEICHARDT (*Immunität, Schutzimpfung, und Serumtherapie. Leipzig: Johann Ambrosius Barth*, 1920, 10. ed., rev., pp. VII+240, figs. 5).—This is the tenth edition of this work, an earlier edition of which has been previously noted (E. S. R., 23, p. 481).

New and nonofficial remedies, 1921 (*Chicago: Amer. Med. Assoc.*, 1921, pp. 418+XXXII).—This is the usual annual report (E. S. R., 43, p. 470).

Rural veterinary secrets, A. H. HARTWIG (*Watertown, Wis.: [Author]*, 1921, pp. 260, figs. 64).—A popular work.

Bacteriology.—General, pathological, and intestinal, A. I. KENDALL (*Philadelphia: Lea & Febiger*, 1921, 2. ed., rev., pp. XI+17-680, pls. 8, figs. 99).—A revised edition of the volume previously noted (E. S. R., 36, p. 177).

The comparative anatomy of the nervous system, I, II, C. U. ARIËNS KAPPERS and A. B. DROOGLEEVER FORTUYN (*Vergleichende Anatomie des Nervensystems, I, II. Haarlem: Erven F. Bohn*, 1920, vols. 1, pp. VIII+370, figs. 116; 2, pt. 1, pp. X+624+XXXII, pls. 4, figs. 326; pt. 2 (1921), pp. IX+625-1329, pls. 10, figs. 316).—The first volume of this work, by Droogleever Fortuyn, deals with the nerve tracts of the various phyla of invertebrates. The second volume, by Ariëns Kappers, deals with vertebrates, including man. The first of the two parts of volume 2 treats of the histology and comparative anatomy of the spinal cord and the medulla oblongata and the second part with the cerebellum, the mesencephalon, and the prosencephalon. Bibliographies and subject and author indexes are given in both volumes.

[Report on the work of the] health of animals branch, S. F. TOLMIE (*Canada Min. Agr. Rpt.*, 1920, pp. 86-96).—This is a discussion of the occurrence and work with infectious and parasitic diseases of live stock during the year.

Report of the veterinary director general for the year ended March 31, 1921, F. TORRANCE (*Canada Dept. Agr., Rpt. Vet. Dir. Gen.*, 1920-21, pp. 27).—This is the usual annual report dealing with the occurrence of infectious diseases, etc.

Reports of the acting government veterinary surgeon for 1919 and of the government veterinary surgeon for 1920, E. T. HOOLE and G. W. STURGESS (*Ceylon Admin. Rpts., Sect. IV, Dept. Agr.*, 1919, pp. F1-F7; 1920, pp. G1-G6).—These are the usual annual reports (E. S. R., 41, p. 680) of the occurrence of infectious diseases of live stock, of control work conducted, etc.

Report of the chief veterinary surgeon for the year 1920, with report of the veterinary bacteriologist, J. M. SINCLAIR and L. E. W. BEVAN (*South.*

Rhodesia, Chief Vet. Surg. Rpt. 1920, pp. 18).—This report, dealing particularly with the occurrence of infectious diseases of live stock, includes a report of the veterinary bacteriologist on work with infectious abortion of cattle and horse sickness.

[Report of the] veterinary division, J. D. BORTHWICK (*Union So. Africa Dept. Agr. Rpt. 1919-20, pp. 19-21*).—A brief summary of the work of the year.

Sensitization due to anthrax bacilli, A. URBAIN (*Compt. Rend. Soc. Biol. [Paris], 86 (1922), No. 1, pp. 9, 10*).—Utilizing as antigen an emulsion of anthrax bacilli, either sporulated or nonsporulated, killed by ether, the authors state that they have obtained evidence of antibodies in the serum of animals immunized against anthrax. The number of these antibodies is always higher in the serum of rabbits thus immunized than in that of the horse immunized with a living antigen.

Experience with the use of the separator for serum production in foot-and-mouth disease, G. BUGGE (*Berlin. Tierärztl. Wchnschr., 37 (1921), No. 23, pp. 265-267, figs. 3*).—The author discusses further the use of the centrifuge or separator for the preparation of blood serum as previously suggested (E. S. R., 44, p. 876). In practice the method has proved very satisfactory when dealing with large amounts of blood. The separation of the serum in small centrifuges is, however, considered too tedious a process to be satisfactory. With a large machine over 50 per cent of the serum can be recovered.

The treatment of foot-and-mouth disease, W. PRIEWE and SCHULTE-HERKENDORF (*Berlin. Tierärztl. Wchnschr., 37 (1921), No. 20, pp. 229-231*).—The authors discuss their experience in the treatment of foot-and-mouth disease in about 2,000 cattle. The intravenous injection of tryptoflavin in connection with heart stimulants in the case of older animals and the intramuscular injection of aolan in young animals is said to have reduced losses to a minimum. A trade preparation Omeisan, which is said to be sodium boroformate, has been used with success as a local antiseptic. Passive and active immunization with serum is recommended where local conditions permit.

Anaphylaxis in the hyperimmunization of cattle against rinderpest, R. VAN SACEGHEM (*Compt. Rend. Soc. Biol. [Paris], 85 (1921), No. 36, pp. 1105, 1106*).—Attention is called to certain conditions under which there is danger of anaphylaxis in the new method of hyperimmunization of cattle against rinderpest by the direct transfusion of the blood of a diseased animal into the blood of an immune animal (E. S. R., 45, p. 883). As the result of considerable experience with this method, the author is convinced that anaphylaxis never occurs if the animal receiving the virulent blood has been vaccinated more than six months previously, but if the transfusion is made in cattle recently vaccinated, cured, or hyperimmunized there is grave danger of anaphylaxis. In such cases resort should be had to subcutaneous inoculation instead of transfusion.

A note on the transmission of surra by ticks, H. E. CROSS and P. G. PATEL (*Punjab Dept. Agr., Vet. Bul. 6 (1921), pp. 3*).—In experiments with *Ornithodoros crossi* Brumpt it was found that the ticks were infective 67, 83, and 101 days after having fed on infected camels but were not up to the end of 46 days, thus indicating that a part of the life cycle is passed within the tick. It is thought that the fact that his new tick is capable of transmitting surra after a long interval may explain why surra breaks out yearly or periodically in the same stables and in the same districts where, so far as can be determined, cases of surra have not been introduced.

No compromise with bovine tuberculosis, L. B. ERNEST (*Jour. Amer. Vet. Med. Assoc., 59 (1921), No. 5, pp. 603-608*).

An atlas and compendium of the more important internal parasites of slaughter-house animals, R. BURI (*Atlas und Grundriss Wichtiger Tierischer Innenschmarotzer Unserer Schlachttiere*. Bern: Paul Haupt, 1920, pp. XII+96, pls. 52).—Accounts are given of parasitic entozoa (15 species including 2 trematodes, 6 cestodes, 6 nematodes, and 1 linguatulid), their classification, and natural history, and of meat inspection and the preparation of demonstration material.

The manner in which nematodes penetrate the body of mammals, histotropism and histodiagnosis, E. BRUMPT (*Compt. Rend. Soc. Biol. [Paris]*, 85 (1921), No. 24, pp. 203–206).—In this comprehensive discussion of the subject, the author points out that since 1898, when Looss, working at Cairo, Egypt, reported the first example of cutaneous histotropism and described the manner in which the larvae of ankylostomes traverse the human skin, this mode of penetration has been recorded for *Strongyloides fülleborni*, by Van Durme in 1902; for *Ankylostomum caninum* and *S. stercoralis*, by Looss in 1901–1903; for *Necator americanus*, by Gomes in 1903; for *S. papillosus*, by Marzocchi in 1907; for *Filaria bancrofti* and *F. immitis*, by Fülleborne in 1908; for *Stephanurus dentatus*, by N. Bernard and Bauche in 1914; and for *Strongyloides westeri*, by Blicke and Baudet in 1921.

In the course of his studies on the development and migrations of various nematode parasites of man and the lower animals and on the immunity to infestation, the author has found that a fragment of the umbilical cord of the newborn calf offers quite an attraction to infestation by *S. vituli*.

Clinical observations on foreign bodies perforating the reticulum, C. C. PALMER (*Vet. Alumni Quart. [Ohio State Univ.]*, 9 (1922), No. 3, pp. 54–68, figs. 2).—The author reports observations of cases of loss of cattle occasioned by foreign bodies in the digestive tract.

Genital infections in the bull, H. L. GILMAN (*Jour. Amer. Vet. Med. Assoc.*, 60 (1922), No. 4, pp. 416–434, figs. 6).—The results thus far obtained by the author are considered to demonstrate that the bull often becomes infected and may be a dangerous source of infection in the herd.

The transmission of agglutinins of *Bacillus abortus* from cow to calf in the colostrum, R. B. LITTLE and M. L. ORCUTT (*Jour. Expt. Med.*, 35 (1922), No. 2, pp. 161–171).—Evidence is presented that the agglutinins toward *B. abortus* found in the blood serum of newborn calves are obtained from the mother through the colostrum. No agglutinins were found in the blood serum of calves at birth, but agglutinins appeared about an hour after the calves had ingested colostrum and reached maximum concentration five hours after feeding. When colostrum was withheld and milk of a low or negative agglutinin titer was substituted, the agglutinins failed to appear.

The elimination of *Bacillus abortus* Bang with the milk, M. R. WINKLER (*Ueber die Ausscheidung des Bazillus abortus Bang mit der Milch*. Inaug. Diss., Tierärztl. Hochsch., Dresden, 1919, pp. 90).—This dissertation consists of the report, with experimental data, of an extensive investigation of the occurrence of *B. abortus* in the milk of infected cows and of the best method of detecting its presence. The report of the investigational work is prefaced by a brief review of the literature on the subject.

The general plan of the investigation consisted in obtaining samples of milk under aseptic conditions, centrifuging it to obtain the milk serum, and using the latter to inoculate guinea pigs. Several weeks after the injection samples of the blood were taken for agglutination tests, the animals were killed, the various organs examined for pathological changes, and cultures made from these organs by the Ascoli method (E. S. R., 31, p. 182). The investigation in-

cluded the examination of the milk of 32 infected cows and 1 goat at varying periods after abortion, and also the examination of 30 samples of market milk.

Of the 32 cows examined, the milk was found to contain abortion bacteria in 13 cases. The goat's milk also contained this organism. The organism appears in the milk fairly soon after abortion and persists for a long time, in 1 case positive results being obtained 2 years and 7 months after the abortion.

Agglutinins were present in the milk serum in 78 per cent of the cases, but the content of the agglutinins was in all cases lower in the milk than in the blood serum. The author is of the opinion that the agglutination titer of the milk serum is of little value in the diagnosis of infectious abortion.

Attempts to detect abortion bacteria directly in the milk were successful in only 3 out of the 32 cases. Guinea pig inoculation is considered by far the best means of detecting the presence of the organism. A characteristic infection of rather long incubation period is brought about, the pathological changes of which are described in detail. The infected guinea pigs show specific agglutinins in the blood, the titer varying from 1:200 and 1:10,000.

Of the 30 guinea pigs inoculated with market milk, 8 died of intercurrent disease, and 7 of the 22 remaining showed abortion infection. Three samples of milk gave positive tests for tubercle as well as abortion bacteria.

Diagnosis of contagious pleuropneumonia of cattle by the complement deviation test, C. GIESE (*Berlin. Tierärztl. Wchnschr.*, 37 (1921), No. 46, pp. 541, 542).—This paper describes an improved method of preparing the antigen for the complement deviation test for contagious pleuropneumonia of cattle, as previously described by Titze and Giese (*E. S. R.*, 43, p. 786). The technique is as follows:

A suspension is made of 200 gm. of freshly ground hog's intestines and 10 gm. of concentrated hydrochloric acid, specific gravity 1.1224, in a liter of distilled water. This is kept at a constant temperature of 50° C. for 24 hours, after which the autolysate is filtered and sterilized at 100° and then mixed with an equal amount of veal broth prepared by infusing 500 gm. of veal in 1 liter of water for 24 hours. The mixture is heated to 80° in a water bath and adjusted with sodium hydroxid to an H-ion concentration of pH=7.6 to 7.8. After heating on the water bath for an hour it is filtered through paper, from 7 to 10 per cent of sterile horse serum is added, and the solution is filtered again through a Berkfeld filter. After its sterility has been established by heating from 24 to 48 hours in the incubator at 37°, the preparation is ready for use.

Losses among sheep in the Rocky Mountain region, G. W. STILES, JR. (*Jour. Amer. Vet. Med. Assoc.*, 59 (1921), No. 3, pp. 322-337).

Gastrointestinal strongylosis of sheep and goats in the Belgian Ruanda, R. VAN SACEGHEM (*Bul. Agr. Congo Belge*, 12 (1921), No. 2, pp. 303, 304).—This is an account of the affection caused by the stomach worm *Haemonchus contortus* Rud. as observed in Ruanda, where it occurs very commonly.

Contagious pneumonia of goats in Ruanda, R. VAN SACEGHEM (*Bul. Agr. Congo Belge*, 12 (1921), No. 3, pp. 502-505).—This disease in Ruanda very often occurs in a form complicated with enteritis. It is caused by a *Salmonella* (*S. capri* Van Saceg.) and not by a *Pasteurella*. The disease is highly contagious, and goats become infected by feeding upon herbage or drinking water contaminated by affected animals. The native sheep is refractory to this disease of goats.

Swine diseases (*Kentucky Sta. Rpt. 1920, pt. 1, p. 39*).—Investigations by the station show rather conclusively that an infectious diarrhea of shotes encountered is the same as the condition existing in various parts of the country and commonly designated as infectious necrotic enterities or intestinal

necrobacillosis. It occurs independently of hog cholera in shotes known to be immune to cholera and in shotes on premises where cholera infection was known not to exist. A study of the intestinal content of sick and healthy pigs showed the presence of numerous protozoan forms, and that they are far more numerous in sick than in healthy shotes. *Trichomonas suis* was always present in pigs suffering with acute necrotic enteritis and was never found in apparently healthy shotes. Although it is not possible to draw definite conclusions as yet, the author's observations suggest that *T. suis* and possibly other protozoan forms are the cause of an acute diarrhea in shotes.

Some studies in swine abortion, F. HAYES (*Jour. Amer. Vet. Med. Assoc.*, 60 (1922), No. 4, pp. 435-452).—This is a report of a year's investigational work at the California Experiment Station on swine abortion, following the preliminary studies by Hayes and Traum (*E. S. R.*, 44, p. 184).

Artificial infection with strains isolated from the three outbreaks noted in the preliminary report was unsuccessful in 5 of the 6 cases in which the sows received the culture either in the feed or by intravenous injection. The breeding qualities of the animals were not materially lessened, although a few of the pigs were born weak and did not survive long. One sow injected intravenously aborted in 27 days. That infection was established in the 5 sows failing to abort was indicated by the production of agglutinins and by recovery of *Bacterium abortus* from the fetal tissues. Antibodies appeared in the serum in about 8 days in the injected animals and in from 21 to 30 days in those fed with cultures.

Monthly agglutination tests were made for about a year on a naturally infected herd of 60 purebred swine in which six abortions had occurred during the month immediately preceding the first agglutination test. The tests were considered positive when complete agglutination occurred with 0.01 cc. of serum added to 1 cc. of the antigen. In the first test there were 29 positive cases including the 6 reactors. In the next test 6 of the negative had changed to positive and 3 of the positive to negative. While the tests fluctuated from month to month, only 11 of the 48 animals tested every month for a year remained consistently negative. Pregnancy and farrowing did not seem to alter consistently the amount of agglutinins in the blood serum.

From limited observations on the agglutination test in young pigs from birth through the suckling period, it is inferred that neither agglutinins nor virulent abortion organisms are transmitted to the offspring at birth or while suckling.

A study of the breeding records of 8 sows out of 11 known aborters in two herds and of sows with positive and negative agglutination tests has led to the conclusion that "natural infection in young gilts 5 to 12 months previous to farrowing does not seem to portend trouble during the first pregnancy to any greater degree than in sows having had previous litters. Positive reacting sows containing *B. abortus* in placental tissues may farrow normal litters, and negative reacting sows may farrow dead pigs. Agglutination by the blood serum, therefore, is no indication of the outcome of pregnancy."

In a preliminary study of the question of possible transmission of the infection by copulation, an examination was made of the testicular tissues of 17 young boars, 10 of which had received injections of cultures of *B. abortus* and 7 had been fed the organism. In the former case all but 1 gave positive agglutination tests in 0.02 cc. in 8 days, while in the latter no great amount of infection could be demonstrated by this test. Injection into guinea pigs of saline suspensions of the testicular tissues of these animals gave negative results, as did the testicular tissue of a naturally infected boar.

The purification and concentration by desiccation of hog cholera immune serum, C. W. DUVAL and M. COURET (*Jour. Med. Research*, 42 (1921),

No. 5, pp. 503-514).—The method employed by the authors in the preparation of a concentrated hog cholera immune serum is essentially as follows:

Fresh immune blood is collected in a sterile glass jar which contains glass beads to aid in defibrinating the blood. The jar is agitated vigorously and allowed to stand over night in a cool place or centrifuged immediately. The serum is then siphoned off and desiccated rapidly over sulphuric acid in vacuo at approximately 10 or 12° C. The dry residue is removed from the container, ground into a fine powder, placed in a glass chamber, sealed to prevent the absorption of moisture, and stored in the dark in a cool place until ready for use. Just before use the powder is redissolved in normal sterile physiological salt solution or sterile distilled water. It is stated that 1 gm. of this powder, which is the equivalent of 10 cc. of pure serum or 15 cc. of defibrinated blood, dissolves readily in 2 cc. of water, thereby concentrating the volume of antitoxin ten times.

A toxin-antitoxin mixture can be prepared by dissolving the antitoxic powder in the virus serum in proper proportions. In numerous animal experiments carried out to determine whether either the virus or the antitoxin is affected by mixing in vitro, no indication was obtained that the power to produce active immunity was impaired.

Infectious abortion in mares (*Kentucky Sta. Rpt. 1920, pt. 1, pp. 37, 38*).—In this progress report it is noted that strains of *Bacillus abortivo-equinus* which have been recultured in the laboratory for many generations retain sufficient virulence to be used in the production of a bacterial vaccine. Thirteen studs of thoroughbred and standardbred mares, numbering 408 animals, were treated with the bacterial vaccine. In 9 of these herds the disease had started before vaccination, 36 mares having aborted, but only 33 mares aborted following vaccination. It is reported that 1 herd of mares which has been vaccinated regularly since 1916 has had no outbreak of the disease.

Experiments to determine the mode of infection have shown that if the live organism is fed it is absorbed from the intestinal tract into the blood stream. This is thought to indicate that mares are usually infected through feeding.

The internal parasites of the horse in Nevada, L. H. WRIGHT (*Jour. Amer. Vet. Med. Assoc.*, 59 (1921), No. 3, pp. 313-321, fig. 1).—This account is based upon 60 animals autopsied and a number of other animals that were given a vermifuge and the parasites found. Identifications of most of the parasites were made by B. H. Ransom.

The action of thymol on the intestinal parasites of the horse, BROCC-ROUSSEU and CAUCHEMEZ (*Bul. Soc. Cent. Méd. Vét.*, 97 (1921), No. 12, pp. 281-286; *abs. in Trop. Vet. Bul.*, 9 (1921), No. 4, pp. 230, 231).—The experiments reported upon show that thymol is rapidly fatal to taenids (*Taenia perfoliata* Goeze) and oxyurids (*Oxyurus curvula* Rud.), less rapidly so to strongylids (*Strongylus vulgaris* Looss, *S. edentatus* Looss), and ascarids (*Ascaris megalocephala* Cloq.), and has practically no effect on oestrids (*Gastrophilus intestinalis* Fab.), nor on Spiroptera (*S. megastoma* Rud.) when within the tumors. It appears that thymol can be successfully employed in the horse as an anthelmintic, and that its action will be greater in proportion to the saturation of the intestinal contents. It is best administered before feeding each morning for three or four days in doses of 10 gm. followed by a copious drink of water, and if necessary the dose may be repeated in 8 to 15 hours.

An unusual form of scabies in fowls, A. B. WICKWARE (*Jour. Parasitol.*, 8 (1921), No. 2, pp. 90, 91, figs. 2).—An acarid identified as *Megninia gallinulae* Buchh. has been found by the author to parasitize fowls at Oka, La Trappe, Quebec. Affected fowls are unable to eat owing to the eyelids being completely glued together. The heads are held down in a rather pendulous state, the

comb, wattles, eyelids, and face being covered with dried exudate and epidermal crusts somewhat similar to those seen in newly recovered cases of chickenpox or a mild form of infraorbital roup. An attempt to infest fowls by rubbing scrapings containing the parasite into the scarified heads of three yearling hens resulted negatively.

Contribution to the knowledge of the genus *Eimeria*, I. O. NIESCHULZ (*Arch. Protistenk.*, 44 (1921), No. 1, pp. 71-82, figs. 3).—This first contribution deals with the biology of the pigeon coccidium (*Coccidium*) *Eimeria pfeifferi*. The author considers it highly probable that the form occurring in pigeons is the same species as that in the chicken. A bibliography of 21 titles is included.

The animal parasites of foxes, with special reference to hookworms, W. A. RILEY and C. P. FITCH (*Jour. Amer. Vet. Med. Assoc.*, 59 (1921), No. 3, pp. 294-305, figs. 3).—Investigations conducted by the authors in Minnesota and by others show the hookworm to be widely distributed and a potential source of serious loss of foxes under unsanitary conditions. Three species are recognized by the authors, namely, *Ancylostoma caninum*, *Uncinaria polaris*, and *U. criniformis*. A list of parasites of foxes by Riley has been noted (*E. S. R.*, 46, p. 686), as has an account by Allen on the treatment of hookworm in the fox (*E. S. R.*, 46, p. 184).

RURAL ENGINEERING.

Rural engineering applied to the colonies, G. PASSELÈGUE (*Ann. Inst. Natl. Agron.*, 2. ser., 15 (1921), pp. 149-175, figs. 10).—A résumé is given of the notes used in introductory lectures of the course in applied colonial rural engineering given by M. Ringelmann at l'Ecole Nationale Supérieure d'Agriculture Coloniale in 1920.

Annual report of the Reclamation Service, 1920-21, E. F. DRAKE (*Canada Dept. Int., Reclam. Serv. Ann. Rpt.*, 1920-21, pp. VI+94, pl. 1, fig. 1).—This report deals with irrigation and drainage operations of the Canadian Reclamation Service for the year 1920-21.

The irrigation work included studies of the duty of water in addition to other more general operations. These showed that during the year the average depth of water required for wheat, oats, and barley was 1.8 ft. and for alfalfa 2.19 ft. On the assumption that all irrigated farms are seeded one-half to alfalfa and one-half to common grains, the total requirement for the entire farm unit was 2 ft. With the legal duty of water at 1.5 ft., it was found that even during dry seasons there is sufficient rainfall to make up the balance of the total requirement.

Report on investigations into the improvement of river discharge measurements, I, E. B. H. WADE (*Egypt Min. Pub. Works, Phys. Dept. Paper 4* (1921), pp. VII+21, pls. 18).—The author reports studies in which a so-called ratchet turbulence gauge was devised to detect errors in current meter ratings in flood waters due to nonuniform flow.

The results obtained led to the conclusion that the errors due to turbulence are unimportant, and that this holds for flood conditions in the Nile. In order that corrections may be applied for such errors if desirable, it is noted that the observed errors in certain cases were less than 0.2 per cent, and it is considered very improbable that the error will amount to 2 per cent.

Irrigation in central Otago, R. B. TENNENT and J. R. MARKS (*New Zeal. Jour. Agr.*, 23 (1921), No. 6, pp. 344-352, figs. 7).—Experiments on the border method of irrigation at the Galloway experimental area are reported.

It is tentatively concluded that checks about 50 ft. wide and 10 chains (660 ft.) long will be the most suitable for central Otago conditions when from

4 to 5 sec.-ft. of water can be obtained for irrigation purposes. It is noted that these experiments were conducted on a thin soil of mica schist origin overlying gravel.

Picric acid as an agricultural explosive, J. SWENEHART (*Agr. Engin.*, 2 (1921), No. 12, pp. 246-248).—In a contribution from the University of Wisconsin, studies made in cooperation with the U. S. D. I. Bureau of Mines and the U. S. D. A. Bureau of Public Roads on the use of picric acid as an agricultural explosive are reported.

Owing to the highly dusty nature of picric acid when dry, it was necessary to eliminate the dust hazard and at the same time not desensitize the material. It was found that 2 per cent of water left in the material relieved the dust hazard and made cartridging possible on a commercial scale. Two per cent moisture reduced the sensitiveness of the picric acid to some extent, but detonation was practically complete when using a No. 8 blasting cap. A 1 per cent moisture content was not sufficient to allay the dust, and 3 per cent moisture or more made detonation difficult or impossible.

It was found that picric acid dries out in air to from 0.1 to 0.2 per cent moisture content in a very short time. When it was packed in unparaffined paper shells the moisture content decreased rapidly even when the filled cartridges were immediately paraffined after filling. It was possible in cartridging operations, when using a good grade of paper, to cartridge the picric acid in undipped shells with the explosive containing much more moisture than would be permissible in the finished product.

In the field tests the picric acid was compared with grade-III TNT. It was found that picric acid detonates with a distinct ball of fire visible by daylight when the explosion is in the open air. The smoke is dark gray in color when detonation is complete, and when it is incomplete a yellowish or greenish colored smoke occurs.

Picric acid was less sensitive to both detonation and outside shock than dynamite. When it contained 2 per cent moisture it was entirely unaffected by 30-caliber high-power rifle bullets at from 50 to 60 ft. It burned about as readily as TNT, and quietly without explosion, in small quantities.

Moisture encountered in ordinary land clearing operations had no more effect on picric acid than on ordinary dynamite. The determining factor in moisture seemed to be the quality of the cartridging work and the thoroughness of the paraffining operation. Cartridges unbroken and left in sloppy, wet soil for 24 hours had apparently perfect detonation. Cartridges slit from end to end and thoroughly tamped into bore holes in moist soil were unaffected on being left over night. Dry picric acid apparently repelled moisture to some extent. Picric acid containing 2 per cent moisture was found to withstand a temperature of 6° F. without apparent effect on detonation.

Experiments on the formation of sensitive compounds by picric acid with lime and iron led to the conclusion that under ordinary soil conditions no dangerous picrate will be formed which will not be desensitized by moisture.

In stumping trials it was found that picric acid is from 30 to 40 per cent stronger than ordinary dynamite and is approximately equal to TNT in strength. The action is not so slow as low-grade dynamite and is more similar to that of 40 to 50 per cent straight nitro-glycerin dynamite. When picric acid contained 2 per cent moisture the speed of the explosive seemed to be reduced. It is considered to be undesirable for ditch work owing to its insensitiveness. It is recommended that picric acid be used in open air agricultural work, provided the material can be secured at a cost lower than that of commercial explosives.

Construction cost keeping and management, H. P. GILLETTE and R. T. DANA (*New York: McGraw-Hill Book Co., Inc., 1922, pp. XVII+572, figs. 264*).—This treatise is intended for engineers, contractors, and superintendents engaged in the management of engineering construction. It contains chapters on laws of management; rules for securing minimum costs; piece-rate, bonus, and other systems of payment; measuring the output of workmen; cost keeping; cost keeping as applied to highway construction; bookkeeping for small contractors; office appliances and methods; miscellaneous cost report blanks and systems of cost keeping; and systems of cost keeping.

Structural drafting and the design of details, C. T. BISHOP (*New York: John Wiley & Sons, Inc., 1920, pp. XIII+352, figs. 291*).—This book is intended to meet the requirements of engineering students, structural draftsmen, and apprentices in structural drafting. It corresponds in scope to the duties of the structural steel draftsman, and covers the preparation of the detailed working drawings for steel structures and the design of the details of construction.

Note on the relative strength of spruce redwood and spruce whitewood (*Picea morinda*), L. N. SEAMAN (*Indian Forester, 48 (1922), No. 1, pp. 34-42, pls. 2*).—Studies are reported which led to the conclusion that spruce redwood is superior to spruce whitewood in spike-holding power, strength, stiffness, toughness, and hardness.

The coefficient of roughness in corrugated-iron pipe, D. L. YARNELL (*Engin. News-Rec., 88 (1922), No. 9, p. 352, fig. 1*).—In a contribution from the U. S. Department of Agriculture, the results of 147 tests of 8- and 10-in. corrugated-iron pipe on nine grades ranging from 0.05 to 1.5 per cent to determine the coefficient of roughness n for Kutter's formula are reported. This coefficient was found to vary from 0.017 to 0.021 for pipe flowing full. There was a rather consistent variation in the values of n for the two sizes of pipe, for which no explanation is offered.

Cement, B. BLOUNT, W. H. WOODCOCK, and H. J. GILLET (*London: Longmans, Green & Co., 1920, pp. XII+284, pls. 28, figs. 55*).—This is one of the monographs on industrial chemistry edited by E. Thorpe. It deals with the manufacture, testing, and use of cement.

Tentative specifications for concrete and reinforced concrete (*Amer. Soc. Civil Engin. Papers and Discussions, 47 (1921), No. 6, pp. 59-124, figs. 18*).—This is a progress report of the joint committee on standard specifications for concrete and reinforced concrete of the American Society of Civil Engineers. It comprises specifications covering the general conditions affecting the use of concrete and reinforced concrete, which are not considered to be complete.

A study of the effect of moisture content upon the expansion and contraction of plain and reinforced concrete, T. MATSUMOTO (*Ill. Univ., Engin. Expt. Sta. Bul. 126 (1921), pp. 37, figs. 12*).—Experiments are reported from which the conclusions are drawn that concrete expands when it absorbs moisture and contracts when it is dried. Concrete of a 1:2:4 mixture is likely to contract during hardening as much as 0.05 per cent in an ordinary structure.

Contraction of concrete by the loss of moisture causes stress in the concrete when it is restrained by an external force. The shrinkage stress caused in the steel in reinforced concrete may reach the usually accepted working stress of steel when the amount of reinforcement is less than 1.5 per cent. The shrinkage stress developed in 1:2:4 concrete may reach the ultimate tensile strength of the concrete when the amount of reinforcement is greater than 1.5 per cent. With richer mixtures the increase in shrinkage stress may be relatively greater than the increase in ultimate strength. The greater the percentage of reinforcement the greater is the tensile stress that may develop in the concrete,

and concrete having a higher percentage of reinforcement than 1.5 per cent is likely to crack unless proper provision is made. In reinforced concrete out of doors subject to alternate wet and dry conditions, cracks may readily be formed under the repeated stress, which is nearly equal to the tensile strength of the concrete.

The Bates experimental road of Illinois, C. OLDER (*Engin. and Contract.*, 57 (1922), No. 9, pp. 199-204, figs. 7).—The progress results of researches on the construction and subsequent behavior of an experimental road described in a previous article (E. S. R., 46, p. 86) are presented.

In subgrade moisture studies it was found that the moisture content near edges and cracks is not materially different from that observed elsewhere. Freezing apparently favored the saturation of a clay subgrade. Studies of subgrade bearing power point strongly to the conclusion that a soil having a given moisture content may under repeated loads have a fairly definite elastic limit. Studies of subgrade uniformity showed a periodic separation of the pavement slab and the subgrade, due to warping of the slab under temperature changes. They also indicated erratic variations due in all probability to uneven settlements of the subgrade.

Observations of frost action showed a heaving or lifting of the edges of the slab throughout the entire length of the road at a much more rapid rate than at the center. This is thought to explain longitudinal cracking of wide slabs, and a longitudinal joint is recommended to prevent erratic cracks.

Studies of temperature effects showed warping of slabs, the edges curling upward at night and down in the daytime. The downward curling in the daytime in many cases lifted the center of the unbroken slab entirely free from the subgrade. There was also a permanent depression of the subgrade at the edges, although a partial recovery occurred as the edges curled up at night. Monolithic brick showed practically the same degree of warping as concrete. A bituminous concrete surface reduced this effect considerably, and was similarly reduced when a brick wearing surface having a bituminous joint filler was used on a concrete base.

Studies of the allowable stresses in plain concrete indicated the probability that plain concrete in transverse bending may be able to withstand an indefinite number of repeated loads, provided the stress is something less than 50 per cent of the modulus of rupture. The relation of these findings to the design of rigid pavements is discussed. It is concluded that "aside from traffic accommodation considerations, roadways of a width such that under normal traffic conditions frequent turning off and on the slab by heavy trucks may be avoided, are much to be desired. The fatigue experiments . . . indicate clearly that the life of a concrete slab may be long or short, depending upon the frequency of the passage of loads great enough to stress the concrete up to 50 per cent or more of its modulus of rupture."

General directions and specifications relating to the tar treatment of roads (*London: Min. Transport, Roads Dept.*, 1921, pp. [2]+19).—These specifications deal with surface tarring on water-bound road, surfacing with tar macadam, and surfacing with single and double pitch grouted macadam.

The section of the application of agricultural mechanics, M. RINGELMANN (*Ann. Inst. Natl. Agron.*, 2, ser., 15 (1921), pp. 109-147, figs. 4).—The history of the section of agricultural mechanics of the Institut Nationale Agonomique of France, which was created in August, 1920, apparently as the result of a long process of development, is briefly presented. The work of the machine-testing station, which apparently is included in the section, is described, with particular reference to the procedure followed in the conception, organization, and execution of projects of research or experimentation. It is

noted that teaching in the subject began at the Institute in 1848 (E. S. R., 44, p. 393).

Rotation dynamometers for tests of agricultural machines, G. MANEIN (*Jour. Agr. Prat., n. ser., 36 (1921), No. 34, pp. 173-176, figs. 6*).—Absorption dynamometers in use by certain French experiment stations are briefly described and illustrated.

Laboratory manual for farm gas engines, F. W. DUFFEE (*Madison, Wis.: Dept. Agr. Engin., Univ. Wis., 1921, pp. 58, figs. 4*).—This manual is adapted primarily for teaching the subject of internal-combustion engines to agricultural college students.

Tractor engines, E. F. HALLOCK (*Cincinnati: Amer. Auto. Digest, 1920, pp. [4]+233, pl. 1, figs. 143*).—The purpose of this handbook is to present information on the construction and economical operation of the tractor engine, its adjustment and repairs, and operation to acquire maximum efficiency. It contains chapters on engine principles, features of construction, major engine parts, valves and valve mechanism, the fuel system, lubrication of the engine, cooling, care of the cooling system, ignition system, care of the ignition system, and engine troubles.

The problem of the adhesion of agricultural tractors, A. ALPE (*Ann. Ist. Agr. [Milan], 15 (1919-20), pp. 1-15, figs. 14*).—Features of the devices used on various tractors of European design for the prevention of drive wheel slippage are discussed.

Leveling device for tractors working on hillsides J. C. WOOLEY (*Agr. Engin., 2 (1921), No. 11, p. 227, fig. 1*).—In a contribution from the University of Missouri a device to permit the leveling of tractors when operating on hillsides is described and illustrated.

Cultivation by motor, A. ALPE (*Ann. Ist. Agr. [Milan], 15 (1919-20), pp. 17-40, figs. 11*).—The mechanical details of some of the more important European motor cultivators are described, with particular reference to rotating pulverizing devices.

The modern motor truck, V. W. PAGÉ (*New York: Norman W. Henley Pub. Co., 1921, pp. 962, pl. 1, figs. 530*).—An attempt is made in this book to treat all forms of motor trucks propelled by gasoline or electric power. Information is given on design, construction, operation, repair, and commercial applications. Chapters are included on motor truck types; the motor truck power plant; motor truck fuel and carburetion systems; truck motor cooling and lubrication; the motor truck electrical system; motor truck clutch and gearbox; motor truck drive systems, motor truck chassis parts, motor truck loading and operation; special truck applications and body designs; road troubles and truck maintenance; gasoline truck repair and adjustment; the electric truck construction; construction, care, and charging of truck batteries; driving and maintenance of electric trucks; and truck operating cost determination.

Motor truck manual (*Cincinnati: Amer. Auto. Digest, 1921, pp. 148, figs. 94*).—This is a practical handbook on the construction and care of motor trucks, and includes chapters on chassis layout; motor truck engine; radiators and cooling system; the transmission and clutch; axles and final drive; universal joints and drive shafts; the steering gear and steering linkage; springs; wheels, rims, and tires; muffler and cutout; motor truck governors; and motor truck bodies.

Motor truck transportation, F. VAN Z. LANE (*New York: D. Van Nostrand Co., 1921, pp. VI+153, figs. 44*).—The purpose of this book is to outline briefly the principles that govern successful motor truck operation. These include such factors as truck operating costs; operating efficiency and cost records;

operating cost laws; truck details such as bodies, loading and unloading devices, trailers, semitrailers, and tires; maintenance; and factors that determine the economical operating fields.

Harness repairing, F. G. BEHREND (Cornell Reading Course for the Farm, No. 160 (1921), pp. 41-83, figs. 46).—Popular information and numerous illustrations are presented relating to the repair of different parts of harness.

Reinforced concrete silos, A. J. PERKINS (So. Aust. Dept. Agr. Bul. 146 (1920), pp. 16-20, figs. 4).—Details of construction of two 97-ton reinforced concrete silos erected at two government experimental farms in South Australia are presented.

Sunshine efficiency of hog houses, F. C. HARRIS (Agr. Engin., 2 (1921), No. 11, pp. 219-227, figs. 9).—This paper reports an investigation of the methods of obtaining sunshine at the proper place and the types of hog houses best adapted for this purpose. Measurements of a large number of sun patterns are presented, together with considerable tabular data.

It is concluded that the properly designed hog house running east and west will admit twice as much sunlight per square foot of glass to the beds as the house running north and south, and that the windows will be less exposed to cold winter winds. The movement of the sun patterns through the building was found to favor the accumulation of more heat on the nests in houses running east and west. Such houses also were found to offer better summer shade on the beds.

It is further concluded that the arrangement of windows used in the east-west types should be used when the building is run diagonally with respect to the compass points, and that wall windows are justified in east-west buildings because of their high efficiency. It was found that the closer the windows can be brought to the beds the greater are their efficiencies from the standpoints of the concentration of warmth and the control of the position of the sun pattern.

Hygienic investigations on new building materials and building methods for small houses, KORFF-PETERSEN (Ztschr. Hyg. u. Infektionskrank., 89 (1919), No. 3, pp. 483-526, figs. 6).—A detailed critical summary of the results of studies of the properties of building materials, with particular reference to heat conductivity and losses and radiation.

Formulas and tabular data are given for the computation of heat conductivity and losses for different types of building materials, especially those used in the construction of small dwellings and farm structures.

Home—farm power and lighting (Cincinnati: Amer. Auto. Digest, 1920, pp. [6]+141, pl. 1, figs. 88).—This is a handbook of instruction on the installation, use, and repair of the internal-combustion engine combined with suitable electrical equipment. It is intended to cover complete electric light and power plants for the home and farm. Part 1 deals with the principles of engine operation; engine construction; operation, care, and maintenance of the internal-combustion engine; and the installation and mounting of auxiliary power plants. Part 2 deals with elementary electricity; wiring electrical circuits; electric generators and motors; storage batteries; and an appendix covering a wiring table.

Sewerage and sewage disposal, L. METCALF and H. P. EDDY (New York: McGraw-Hill Book Co., Inc., 1922, pp. XIV+598, figs. 220).—This represents a single volume abridgment of a three-volume work entitled American Sewerage Practice, published by the authors in 1914-1915 (E. S. R., 34, p. 886).

Sewage and sewerage of farm homes, G. M. WARREN (U. S. Dept. Agr., Farmers' Bul. 1227 (1922), pp. 55, figs. 35).—The purposes of this publication are to emphasize basic principles of sanitation and to give directions for constructing and operating simple, serviceable, and safe home sewerage works. Such subjects as the nature and quantity of sewage, sewage-borne diseases, the

decomposition of sewage, and the importance of air in sewage treatment are discussed, and practical utilities, including different types of privies, septic-tank disposal systems, and grease traps, are described.

With reference to the selection and design of a small sewage disposal system it is stated that "what is the best method and what the best outfit are questions not to be answered offhand from afar. A treatment that is a success in one location may be a failure in another. In every instance decision should be based upon field data and full knowledge of the local needs and conditions. An installation planned from assumed conditions may work harm."

Adsorption in sand filters, J. DON (*Engineering* [London], 111 (1921), No. 2894, pp. 759, 760, figs. 2).—Experiments are reported which showed that under laboratory conditions a sand filter freshly prepared is capable of adsorbing fairly large amounts of ammonia and dissolved organic substances, and that this action takes place rapidly. Sand which has ceased to adsorb dissolved substances must be thoroughly washed before commencing another set of experiments. In a comparison of the effect of sand with that of polarite or permutit, it was found that the action of the two artificial purifiers is to a great extent a chemical interchange, and it is thought that probably not much true adsorption occurs.

RURAL ECONOMICS AND SOCIOLOGY.

Changes in farm organization and farm practice as shown by a study of the business side of farming in several sections of the country, H. M. DIXON (*Jour. Farm Econ.*, 3 (1921), No. 4, pp. 161-167).—Data from eight areas where farm business and farm organization surveys have been conducted over a period of years are briefly summarized in so far as they indicate changes in types of farming.

In Washington County, Ohio, a change from sheep farming to a type involving the keeping of more cattle and hogs is noticeable.

Records for eight years obtained in Clinton County, Ind., reveal an increase in corn acreage and a decrease in small grains and hay.

From a study of 150 farms in Frederick County, Va., carried on over a five-year period, it appears that the orchard enterprise has developed at the expense of general crop and live-stock farming and general farming with a small area devoted to fruit. The five-year average labor income of the general farms was \$235, of the general fruit \$618, and of the orchard farms \$2,358.

Dane County, Wis., shows an increase in the number of cows per farm and production per cow, accompanied by a decrease in hogs.

Records taken on 500 farms in Sumter County, Ga., in 1913 and in 1918 indicate the following changes: A reduction of one-third in the cotton acreage and an increase of one-third in the corn acreage; an increase in the wheat crop, which was grown only on the occasional farm in 1913, but on about two-thirds of the farms in 1918; a growing importance of the peanut as a cash crop; the introduction of the velvet bean, interplanted with corn and utilized largely as a feed crop; a noticeable increase in the production of feed crops; an increase in live-stock production, particularly of hogs; lighter application of fertilizers on cotton as well as other crops; and an increase in the acreage of legumes.

A comparison of data taken on 246 farms in the Palouse region of Idaho and Washington in 1914 and in 1919 shows that the enterprise of wheat and peas has been expanded to a much greater extent than those of oats and live stock, indicating also changes in the relative acreage of winter and spring wheat and that of peas and beans raised in place of summer fallow.

In the trucking area of Hillsboro County, Fla., between 1917 and 1920, strawberries have consistently shown the best returns per acre. The acreage in

velvet beans, cowpeas, and peanuts has been increasing, and better grades of live stock are being introduced.

In the citrus fruit area of Polk County, Fla., grapefruit plantings are on the decline in relation to those of oranges, and tangerine plantings are markedly increasing.

Farm business in Quebec, J. A. STE. MARIE (*Canada Expt. Farms Bul.* 98 [1921], pp. 24, figs. 4).—For the second agricultural survey in 6 counties in Quebec, about 10 or 12 representative farms were chosen in 4 or 5 parishes surrounding the parish or district surveyed the preceding year (E. S. R., 44, p. 288).

The average labor income was higher than that for the same districts as reported in the survey of 1919. All groups of farms were making a plus labor income, varying from \$381 to \$607, with an average of \$463. The data show a difference of \$236 in favor of the group of farms varying in size from 81 to 100 acres and a difference of only \$83 between the average of the smallest and the average of the largest farms.

The most advantageous one-man farm is shown to consist of from 81 to 100 acres, two-man farm from 141 to 160 acres, and three-man farm 200 or more.

The results of the survey of groups of farms devoted to dairying for city trade, dairying plus a cash crop, and general dairy farms are said to concur closely with the findings of last year's survey and demonstrate that the possibility of making a plus labor income does not vary greatly with any type of farming. It is demonstrated also that the question of a fair plus labor income is not so much a question of location and type of farming as of good management within the type chosen.

The survey included an investigation of the revenue obtained per cow as influenced by purebred sires, the cost of milk production, and certain other factors influencing success in farming.

Ranch cost accounting, C. W. COLLINS (In *Accounting—Theory and Practice*, R. B. KESTER ET AL. New York: Ronald Press Co., 1921, vol. 3, pp. 226-274).—This chapter is found in volume 3 of a series of texts on accounting, in which a study is made of accounting principles as definitely applied to various businesses. The subject of ranch accounting is treated from the viewpoint of the accountant, in order to make clear the principles involved and to aid those interested in designing and supervising systems for such an agricultural enterprise. It is developed in sections on accounting organization and records, inventories, and closing entries.

Who owns the agricultural land in the United States? G. S. WEHRWEIN (*Jour. Farm Econ.*, 4 (1922), No. 1, pp. 34-45).—The author reviews the returns from the censuses of 1900, 1910, and 1920, with respect to owner operators, tenant operators, and manager operators, touching briefly upon the problems of concentration of ownership, absentee and alien ownership, ownership by the large landholder or corporation, and that by low-standard nationalities. Discussion is contributed by C. L. Stewart.

Farm tenancy in 1920, B. H. HIBBARD (*Jour. Farm Econ.*, 3 (1921), No. 4, pp. 168-175).—Various studies of tenancy and conclusions drawn therefrom are noted. Statistics from the census of 1920 are reviewed.

Tenancy has decreased in a group of 13 northeastern States. It has positively declined also in Kentucky, Alabama, and Oklahoma, while Tennessee, Georgia, and Mississippi repeat the exact figures of 1910. Missouri and Nevada also show decreases, all other States increase.

In three geographic divisions, the New England States, the Middle Atlantic and the East South Central States, the percentage of tenancy has declined, while in the West South Central States the percentage of increase was very

slight. In the West North Central States it was the most pronounced. It is pointed out that the gains are very largely in sections of the country particularly important in the production of cereals and cotton.

Discussing changes in the kinds of tenancy, the author states that the number of cash tenants has decreased by 30 per cent, while the share tenants have increased almost 20 per cent. Certain correlations between tenancy, the selling value of land, and type of farming are discussed.

Agriculture and taxes, L. DE VOGUÉ (*Jour. Agr. Prat.*, n. ser., 37 (1922), No. 1, pp. 10-15).—Data are presented briefly in order to refute certain statements that agriculture does not contribute fairly with commerce and industry to the national budget in France.

The shifting of taxes on sales of land and capital goods and on loans, H. G. BROWN (*Jour. Polit. Econ.*, 29 (1921), No. 8, pp. 643-653).—The incidence of a tax on sales of land and capital goods, as well as on loans, is shown to be partly on income from labor (when borne by purchasers or borrowers for ownership and production), partly on consumers' surplus (when borne by persons who buy or borrow in order to get title to their homes), and, in the case of loans, partly on interest (when borne by lenders). Many possible effects of these taxes are considered.

Economic conditions causing the two-day cattle market at Chicago and the effect of the zoning law, R. H. WILCOX (*Jour. Farm Econ.*, 3 (1921), No. 4, pp. 176-182).—The factors which caused Monday and Wednesday to be days of heavy receipts and buying on the Chicago cattle market are accounted for. The zoning system, inaugurated by the U. S. Food Administration, dividing the short-haul Chicago traffic from the long-haul, is shown to have reduced the fluctuations in receipts and in prices.

Brief on behalf of American Farm Bureau Federation, intervener, THORNE and JACKSON (*Chicago: Amer. Farm Bur. Fed.*, 1921, pp. [2]+39, figs. 4).—A revision in the freight rates on live stock throughout the western portion of the United States was requested from the Interstate Commerce Commission. This brief, assembled in July, 1921, contains testimony as to the actual condition in the live-stock industry and summaries of computations which are said to prove that live-stock traffic was the most profitable of numerous commodities which were analyzed, constituting the bulk of the tonnage handled by the railroads in this territory. The net return on the live-stock traffic was said to be 12.2 per cent. Data are included also showing the falling off in profits and decline in the production of cattle and hogs. The fact is illustrated that the prices of live stock were advanced to a high level during the war period but that they dropped back to a prewar basis, while freight rates advanced to a high point and remained there.

[**Annual report of the United Grain Growers Limited for 1921**], T. A. CRERAR ET AL. (*United Grain Growers Ann. Rpt. 1921*, pp. 94, figs. 13).—This includes a report by the president on behalf of the board of directors, the auditors' report, and the general manager's report.

Rural primary groups, J. H. KOLB (*Wisconsin Sta. Research Bul.* 51 (1921), pp. 82, figs. 23).—One hundred and twenty-one groups in the rural population of east and west Dane County, Wis., have been defined and mapped to show their political and natural history, trade areas, farmers' organizations, schools, village centers, and improvements. By the primary or neighborhood group is meant that first group beyond the family which has social significance and some local consciousness of unity and usually a characteristic group name. The names of 95 of the groups represented were designated as having an economic, educational, kinship, local government, nationality, religious, or social meaning. These groups were found to owe their original existence to

such factors or combinations of factors as topography and original vegetation, nationality bonds, religious purpose, migration from a common place of residence, and economic or social purposes. Only 18 were found in which changes were not easily recognizable. Certain conclusions reached are that organization plans must recognize rural primary groups, that village and rural groups must federate, that active primary groups and the village center should form a community, that the nongrouped areas need organization, and that the intercommunity organization on the county basis is necessary for administrative purposes.

Some fundamentals of rural community organization, D. SANDERSON (*Jour. Rural Ed.*, 1 (1921), No. 1, pp. 28-37).—This is a discussion of the object or nature of community organization and of association in a community, as determining what methods of an organization may be desirable.

Training for rural service (*Rural Leadership Council, Bd. Home Missions, Methodist Episc. Church, Proc.*, 2 (1921), pp. 70).—Proceedings of the Second Rural Leadership Council, held by the department of rural work, Board of Home Missions and Church Extension of the Methodist Episcopal Church, are printed here. The papers presented herewith represent conclusions and suggest plans based upon two years' experience in the field. Committee reports and a list of publications by the department of rural work are included.

Cooperation in Rumania, D. COFFEY (*Better Business*, 7 (1921), No. 1, pp. 44-52; *Irish Econ.*, 7 (1922), No. 2, pp. 124-130).—An historical account of the cooperative movement as affecting agriculture is given, together with a brief description of some forms of agricultural cooperative societies in Rumania.

The cooperative organization of an Indian Province, R. B. EWBANK (*Better Business*, 7 (1921), No. 1, pp. 1-11).—This paper deals with the Presidency of Bombay, being an account of the situation prompting government action providing cooperative organization for the benefit of agriculture and of the system evolved.

Economic conditions in the Philippines, H. H. MILLER (*Boston and London: Ginn & Co.*, 1920, rev. ed., pp. XI+476, figs. 123).—Three-fourths of this textbook in commercial geography, prepared especially by the Philippine Bureau of Education for the fourth year of the secondary course, is an outline for the study of important economic crops of the Philippines, including rice, corn, abaca, copra, sugar, tobacco, and minor ones, also of land tenure, sources of agricultural labor, and customs and living conditions of laborers. A brief chapter is devoted to the animal industry.

[Land tenure and settlement and agricultural production in Australia], G. H. KNIBBS and J. STONHAM (*Aust. Off. Yearbook*, No. 14 (1921), pp. 158-326, figs. 6).—These pages present statistical information for the period 1901-1920, inclusive, continuing the series previously noted (*E. S. R.*, 45, p. 397).

[Land tenure and agriculture in the Union of South Africa], C. W. COUSINS ET AL. (*Union So. Africa, Off. Yearbook*, No. 4 (1921), pp. 465-563).—These pages continue for the period 1910-1920 reports previously noted (*E. S. R.*, 44, p. 492).

Agricultural report for the year 1921, M. CASORIA (*Egypte Contemporaine*, 13 (1922), No. 62, pp. 44-97).—Statistical information upon production and commerce in the principal agricultural crops, including cotton, cereals, sugar cane, rice, and fruits, is assembled in these pages. Similar notes are included for live stock. Mention is made of the extent of the use of chemical fertilizers, motor cultivation, the status of agricultural societies, and other phases of agriculture in Egypt.

AGRICULTURAL EDUCATION.

Education in forestry (*U. S. Bur. Ed. Bul. 44* (1921), pp. 70).—This bulletin embodies the proceedings of the Second National Conference on Education in Forestry held at New Haven, Conn., December 17 and 18, 1920.

In a committee report on the undergraduate course leading to the degree of bachelor of science in forestry, it is recommended that the first two years should be devoted primarily to fundamental subjects like English, chemistry, botany, geology, mathematics, mechanical drawing, and civil engineering; that technical forestry courses should come mainly in the junior and senior years; that more courses in economics should be included; and that specialization may be permitted in the junior and senior years with the proper approval and supervision of the faculty. A suggested curriculum is outlined.

Three groups into which forestry subjects are said to fall are outlined in the report of the committee on the course leading to the degree of master of forestry. These are called the economics, technique, and business groups. The economics group is said to have as its fundamental sciences forest history and forest economics, its practical application being in policies crystallized and expressed by laws. The group termed "technique" is based on the physical and chemical sciences, with special application to forestry. The basis of the business group is mathematics and mechanical drawing, including accounting and surveying. A detailed study of the variation and arrangement in subjects now offered in four and five-year courses at several institutions is made, with suggestions.

The report of the committee on specialization by students in their work for the professional degrees of bachelor of science in forestry and master of forestry before they have completed the general course covering the field of forestry answers the question to the effect that no student should be encouraged to specialize before receiving a professional degree. Differentiation is recommended in the training of technical and research men.

A report is made on the scope and character of training for specialists in forest products, the committee emphasizing the large and undeveloped field for the employment of men technically trained in the utilization of forest products and suggesting courses for the training of engineers and chemists in this field.

The report of the committee on the field and scope of vocational training in forestry is in two parts. The first, prepared by J. B. Berry, describes five lines of preparation which may be promoted under the Vocational Education Act of 1917 and outlines certain major and minor projects. Part 2, covering the subject of ranger schools, was prepared by E. A. Ziegler.

Forestry teaching in the elementary grades, advocated in a report by P. P. Claxton.

The value of an agricultural education, E. C. JOHNSON (*School and Soc.*, 15 (1922), No. 379, pp. 367, 368).—This discusses the answers received to a letter sent out to alumni of the Washington College as previously noted (*E. S. R.*, 46, p. 797).

Rural school supervision as an agency for improving rural schools, I. DAVIDSON (*Jour. Rural Ed.*, 1 (1921), No. 1, pp. 3-12).—Examples are cited of rural supervision as established in Wisconsin, New Jersey, and Maryland. The work of the rural supervisor is said to have three objectives, the improvement of the teacher, of the quality of her teaching, and of the school and community. It involves the removal of obstacles, principally by means of the consolidated school, restricting the area and number of teachers to be supervised; and support from the superintendent, careful selection of persons to serve as supervisors, and the improvement of the technique of supervision.

Schooling in one-teacher schools, F. P. O'BRIEN and T. J. SMART (*Jour. Rural Ed.*, 1 (1921), No. 3, pp. 106-119, fig. 1).—This is a comparative study of the results of instruction and the educational facilities provided in some one-teacher schools and in a central graded school in the northeastern part of Johnson County, Kans. Standardized tests were used in measuring the results of instruction in arithmetic, handwriting, reading, composition, and group intelligence in all grades from the third to the eighth inclusive. Evidence is presented of the superiority of the graded school in building, library, and playground facilities. The teaching results in the essential subjects tested showed a general and marked inferiority for the one-teacher schools, although their pupils showed equal mental ability as measured by an intelligence test. The inferior instruction of the one-teacher schools is more expensive per pupil in average daily attendance in all but one of the one-teacher schools.

Junior club activities in the public elementary schools, F. H. CLARK (*Jour. Rural Ed.*, 1 (1921), No. 2, pp. 80-83).—Greater independence for the school and the community in the selection of projects with less supervision from outside is advocated.

Stimulating interest in vocational agriculture through junior project work, J. D. BLACKWELL (*Jour. Rural Ed.*, 1 (1921), No. 2, pp. 76-79).—The aims and characteristics in junior project work, typical projects, the important considerations in organization and supervision, subject matter, credit, and some of the new outstanding problems are set down in outline.

Wisconsin laws relating to vocational education (*Wis. Bd. Vocat. Ed. Bul.* 4 (1921), pp. 21).—This supplements information previously noted (*E. S. R.*, 43, p. 598).

Rosenwald schools in Virginia, W. D. GRESHAM (*South. Workman*, 51 (1922), No. 4, pp. 169-176, figs. 9).—It is said that there will soon be more than 100 schoolhouses for negroes erected with the aid of the Rosenwald fund. The allotment from this is now appropriated to the State Board of Education of Virginia, and the expenditures are made on approval of the supervisor of negro education and in accordance with plans and specifications furnished through the Rosenwald Foundation. Several of these new school buildings in various counties of the State are described and illustrated.

Agricultural education, T. AMADEO (*Min. Agr. Argentina, Mem. Cong. Nac.*, 1920, pp. 97-116).—These pages present a report on several agricultural schools in Argentina for the year 1920.

Scheme of agricultural education, 1919-20, G. H. GATER (*Preston: Lancashire County Council, Ed. Com., Agr. Dept.*, 1919, pp. 81).—Announcement is made by the agricultural department of the Lancashire Education Committee of educational work at the Lancashire County Council Farm, Hutton, England, giving syllabuses of courses offered in the dairy, poultry, and horticultural schools. Practical instruction for farmers at the Harris Institute, Preston, and miscellaneous lectures offered by the council are similarly set forth.

Reorganization of agricultural education in Germany, H. KRAEMER (*Schweiz. Arch. Tierheilk.*, 64 (1922), No. 1, pp. 32-36).—Proposals were made at a recent conference of German specialists in agricultural education at Berlin to shorten the course leading to a diploma in agriculture and to limit the amount of general science offered, especially in the four-semester course for practical farmers, in order to include more special science and economics. Five- and six-semester courses for agricultural officers and specialists are to include seminar and laboratory work, with more courses in agricultural history, commerce, geography, agricultural technology, irrigation, tropical agriculture, and pedagogy.

A short review of agriculture and forestry in Norway and of official efforts for their advancement, O. T. BJANES (*Christiania: Dept. Agr., 1921, pp. 64, figs. 40*).—This reports upon the official administration of agricultural affairs in Norway and describes the redistribution of agricultural holdings and other legislation concerning agriculture and forestry. A considerable portion of this account is devoted to the agricultural school system.

The school of farm home management at the Experimental Garden of Hamma in Algiers (*Rev. Hort. Algérie, 25 (1921), No. 2, pp. 39, 40*).—This school for theoretical and practical education for young women is briefly described.

A unit course in swine husbandry, C. H. SCHOPMEYER (*Fed. Bd. Vocat. Ed. Bul. 68 (1921), pp. 44*).—This syllabus is intended for teachers of vocational agriculture, teacher trainers, and others who are responsible for the organization of the subjects to be taught in vocational agricultural courses in secondary schools and in part-time or evening classes.

Lessons for members of the boys' and girls' garden clubs, G. L. TIEBOUT and H. C. SMITH (*La. Agr. Col. Ext. Circs. 51 (1921), pp. 58, figs. 6; 52 (1922), pp. 41, figs. 6*).—These circulars outline a course in gardening covering four years.

Books on health as related to the school child (*N. Y. State Univ. Bul. 729 (1921), 2. ed., rev., pp. 37*).—Books, bibliographies, and periodicals are presented under the topics of hygiene, health books suitable to children of school age, school hygiene, open-air schools, medical inspection of schools, nursing, oral hygiene, mental hygiene, mental retardation and deficiency, nutrition, sex education, speech defects, vision and hearing, tuberculosis, dispensaries, social service, anthropometry, and physical education.

MISCELLANEOUS.

Thirty-fourth Annual Report of New York Cornell Station, 1921, A. R. MANN (*New York Cornell Sta. Rpt. 1921, pp. 97+5*).—This report, presented as usual as that of the dean and director of the New York State College of Agriculture and the Cornell Station, contains the organization list, data relating to the work and publications of the station, and a financial statement for the fiscal year ended June 30, 1921.

Thirty-third Annual Report of Kentucky Station, 1920, I. T. COOPER (*Kentucky Sta. Rpt. 1920, pt. 1, pp. 49*).—This contains the organization list, a financial statement as to the Federal funds for the fiscal year ended June 30, 1920, a report of the director on the work and publications of the year, and meteorological data. The experimental work reported is for the most part abstracted elsewhere in this issue.

Omnium agricole, a practical encyclopedia of modern agriculture, H. SAGNIEB ET AL. (*Omnium Agricole. Dictionnaire Pratique de l'Agriculture Moderne. [Paris]: Libr. Hachette, 1920, pp. [4]+794, pls. 11, figs. 1113*).—This cyclopedia of agriculture consists of many brief articles, mostly by a corps of 28 collaborators, on the various phases of farm practice and farm life, especially in France and the French colonies. The preface is by J. Méline.

NOTES.

California University.—Dr. David P. Barrows tendered his resignation as president May 16.

Purdue University.—Chancellor Edward C. Elliott of the University of Montana has accepted the presidency of the University.

New Jersey Stations.—The division of horticulture has recently received donations of material from a number of floricultural farms in New Jersey and vicinity. Some of the specimens will be used for experimentation and others for ornamental plantings. It is planned to resume on a more extensive scale the floricultural investigations, many of which were discontinued during the war period.

New York State Station.—A conference of manufacturers, experts, and others interested in the development of a vigorous cheese industry in the State was held under the auspices of the station June 1. Cheese specialists from the New York State College of Agriculture and the station explained the results of some of their bacteriological and chemical investigations, and discussed ways in which science can aid in the production and marketing of good cheese. Among the resolutions adopted by the conference was one advocating the extension of the activities of both these institutions in this direction.

A fellowship offered by the Crop Protection Institute to promote original research as to the insecticidal properties of sulphur has been located at the station.

W. H. Rankin, Ph. D., plant pathologist for the Dominion of Canada, has been appointed an associate in research (plant pathology), effective July 1, and will take up a special study of diseases and insects affecting raspberries, particularly in the Hudson River Valley. This work has been made possible by a special grant by the legislature.

D. W. Carpenter, Ph. D., assistant professor of physical chemistry at the University of Iowa, has been appointed associate in research (chemistry), beginning July 1. W. L. Kulp, assistant in research (biochemistry), has resigned, effective on the same date, to accept a teaching fellowship in bacteriology and biochemistry at Yale University, the vacancy being filled by the transfer of Millard G. Moore, assistant chemist.

Fred R. Clark, assistant in research (horticulture), has resigned, effective August 15, to accept a teaching position in the department of botany of the Rhode Island College.

E. E. Clayton, Ph. D., extension plant pathologist at the Ohio State University, has been appointed plant pathologist at the newly established field station on Long Island, entering upon his new duties June 1. H. C. Hockett, a graduate student at Cornell University, has been appointed associate entomologist, beginning July 1.

Sulphur Fellowships of National Research Council.—Several fellowships are being offered through the National Research Council for fundamental investigations on the agricultural applications of sulphur. The funds for these fellowships have been obtained by a grant from a Texas sulphur company, and it is expected that the support will be extended from year to year for some time as the results may warrant.

The work to be prosecuted under these fellowships will include investigations on the value of sulphur in the control of potato scab, nematodes, soil insects, and sweet potato diseases. The value of sulphur as a fertilizer for alfalfa and other legumes, and the effect of sulphur on alkali soils are also to be studied.

Applications for the fellowships are restricted to graduate students or members of experiment station staffs. Fellows are expected to devote practically their entire time to the investigations, except for such course work as may be necessary to meet the requirements for an advanced degree. Each fellowship will carry an annual stipend of approximately \$1,000, and will be administered by a special sulphur fellowship committee of the advisory board of the American Society of Agronomy, in conference with the executive committee of the division of biology and agriculture of the National Research Council. Inquiries and applications should be addressed to the Sulphur Fellowship Committee, National Research Council, Washington, D. C.

Appalachian Forest Experiment Station.—This station has been organized recently by the Forest Service of the U. S. Department of Agriculture, with headquarters for the present at Asheville, N. C., and with the large and important hardwood timber region of the southern Appalachian Mountains, including the Cumberland, Allegheny, and Piedmont Plateaus, and the Coastal Plain region of North Carolina, Virginia, Maryland, and Delaware as the field of its operations. Available funds are not sufficient to permit the construction of buildings and the requisite laboratory facilities, and for the first few years the work of the station will be concentrated on the most urgent silvicultural problems, the solution of which is of paramount importance in the proper management of forest lands in order to insure a continuous supply of timber and other forest products.

The work is being directed by E. H. Frothingham, who comes to the station with a background of over twelve years of investigative work with the Forest Service throughout the eastern United States. The other members of the staff are E. F. McCarthy, for nine years a member of the teaching staff of the New York State College of Forestry at Syracuse University, and recently research specialist with the Canadian Conservation Commission; C. F. Korstian, recently in charge of research in the Intermountain District of the Forest Service at Ogden, Utah; and F. W. Haasis, until recently a member of the staff of the Fort Valley Forest Experiment Station near Flagstaff, Ariz.

New York State Institute of Applied Agriculture.—An acre and a half of ground at this institution, located at Farmingdale, Long Island, has just been laid out in plats 13 by 20 feet and planted to the various grasses and clovers. The plats are to be used directly for instructional work and indirectly to establish the comparative adaptability of the plants grown therein.

George F. Goodearl, of the Connecticut College, has been appointed an instructor in poultry husbandry and has entered upon his duties.

Miscellaneous.—*Journal of the Japanese Society of Veterinary Science* is being published monthly with Drs. K. Muto and N. Nitta as editors. The initial number contains three articles entitled, respectively, On the Nature of Lumbar Paralysis in the Goat (in Japanese with English abstract), by O. Emoto; The Treatment of Prolapse of the Rectum through Laparotomy in Small Animals (in German), by S. Matsura; and On Antirabic Vaccination in the Dog (in English), by S. Kondo.

Dr. Wm. Bateson, director of the John Innes Horticultural Institution, has been elected to succeed the late Lord Harcourt as a trustee of the British Museum.

INDEX OF NAMES.

- Aaltonen, V. T., 738.
 Abbot, C. G., 115.
 Abbott, A. C., 374.
 Abderhalden, E., 470.
 Abel, M. H., 792.
 Acél, D., 615.
 Acree, S. F., 413.
 Adametz, L., 270.
 Adams, J. F., 239, 547, 645, 846.
 Adams, R., 414.
 Adams, R. L., 389, 693, 783.
 Agee, H. P., 550.
 Agee, J. H., 119.
 Aggéry, B., 48.
 Agne, R. C., 89.
 Agnoletti, G., 72.
 Ahr, J., 729.
 Åkerman, Å., 636.
 Albertson, G. W., 560.
 Albiston, H. E., 777.
 Albrecht, W. A., 315.
 Albuquerque, J. P. D', 534.
 Aldaba, V. C., 643.
 Aldrich, 459.
 Alexander, C. P., 57, 460.
 Alexander, W. H., 510.
 Alford, E. C., 614.
 Allander, B., 683.
 Allen, E. W., 3, 598.
 Allen, H. R. (England), 773.
 Allen, H. R. (Ky.), 322.
 Allen, J. A., 184, 185.
 Allen, W. H., 189.
 Alliot, E. A., 614.
 Allred, C. E., 784.
 Almeida, A. O. de, 671.
 Almy, L. H., 664.
 Alpe, A., 890.
 Alsberg, C. L., 202.
 Alviella, F. G. d', 42.
 Alvord, J. W., 115.
 Alway, F. J., 216.
 Amadeo, T., 897.
 Amberger, K., 807.
 Ambrose, M., 792.
 Ames, J. W., 428.
 Amin, M., 455.
 Amott, A. L., 97.
 Ananda Rao, D., 276.
 Anderson, A. C., 69.
 Anderson, A. P., 86.
 Anderson, E. G., 634.
 Anderson, G. F., 536.
 Anderson, H. A., 688.
 Anderson, H. W., 47.
 Anderson, J. A., 503.
 Anderson, J. P., 222.
 Anderson, P. J., 38, 197, 651.
 Anderson, R. J., 308.
 Anderson, S., 307.
 Anderson, T. J., 557.
 Andress, J. M., 194.
 Andrew, L. A., 494.
 Andrews, E. A., 252.
 Andrews, F., 293.
 Andrews, M. E., 590.
 Andrews, W. H., 776.
 Andrieu, A., 184.
 Angeletti, A., 626.
 Angelis d'Ossat, G. de, 627.
 Angell, E. I., 422.
 Angiolini, A., 224.
 Angot, A., 314.
 Angremond, A. d', 252.
 Ångström, A., 208.
 Anson, B. J., 750.
 Anstead, R. D., 520.
 Anthony, R. D., 444.
 App, F., 530.
 App, H. M., 396.
 Appel, O., 533.
 Appleton, V. B., 63.
 Archer, R. T., 771.
 Archer, W. A., 97.
 Archibald, J. G., 197.
 Ardagh, E. G., 203.
 Arens, P., 461.
 Ariëns Kappers, C. U., 880.
 Arkell, H. S., 770.
 Armbruster, L., 463.
 Armes, M. J., 700.
 Armsby, H. P., 105, 764.
 Arnaud, G., 44.
 Arnett, C. N., 364.
 Arnhart, L., 51.
 Arnold, W. L., 455.
 Arny, A. C., 829, 830.
 Aron, H., 256.
 Artis, G. H., 214.
 Asbury, S. E., 124.
 Ashbrook, F. G., 655.
 Ashby, A. W., 192.
 Ashby, S. F., 246, 453.
 Ashton, W. E., 372.
 Asmundson, V. S., 770.
 Attack, F. W., 9.
 Atkins, H. D., 614.
 Atkins, W. R. G., 53, 133, 460, 525.
 Atwater, W. O., 602.
 Atwood, M. V., 89.
 Aull, G. H., 519.
 Aumiot, J., 835.
 Austin, M. M., 626.
 Avery, O. T., 78, 866.
 Avery, P. M., 413.
 Ayers, S. H., 76, 274.
 Ayres, Q. C., 98, 779.
 Aynaud, M., 484.
 Ayyangar, G. N. R., 134.
 Azzi, G., 15.
 Babbitt, S. D., 295.
 Babcock, E. B., 223, 721.
 Bach, S., 430, 433.
 Bacon, P. E., 372.
 Bacot, A. W., 800.
 Badano, C. H., 184.
 Baerg, W. J., 658.
 Baez, J. R., 448.
 Bagley, W. C., 193.
 Bagué, J., 580, 582.
 Bailey, C. H., 500, 612, 828.
 Bailey, C. V., 166, 671.
 Bailey, E. H. S., 468, 859.
 Bailey, E. M., 522.
 Bailey, I. M., 695.
 Bailey, I. W., 128.
 Bailey, L. H., 735, 838.
 Bailey, M. A., 846.
 Bailey, P. G., 272.
 Bailhache, G., 337.
 Bain, H. F., 491.
 Bainbridge, F., 22.
 Baker, A. C., 154.
 Baker, F. S., 447.
 Baker, L. V., 167.
 Bakewell, R., 872.
 Bakke, A. L., 241, 539.
 Bal, S. N., 344, 348.
 Baldwin, F. C., 89.
 Balfour, A., 248.
 Ball, C. R., 29.
 Ball, K. F., 95.
 Ballard, C. W., 322.
 Ballard, W. W., 834.
 Ballou, H. A., 56, 559.
 Balls, W. L., 730.
 Bancroft, R. L., 320.
 Bancroft, W. D., 264.
 Bane, J. L., 597.
 Barbarin, R. E., 480.
 Barber, H. S., 857.
 Barber, M. A., 180, 856.
 Barclay, J. R., 766.
 Bardelli, P. C., 481.
 Bardsley, J. H., 97.

- Barker, A. F., 770.
 Barker, B. T. P., 38.
 Barker, J. R., 197.
 Barker, J. W., 414.
 Barlot, J., 724.
 Barnes, A. C. (Brit. E. Africa), 273.
 Barnes, A. C. (Corona, Calif.), 424.
 Barnes, M. F., 686.
 Barney, R. L., 750.
 Barois, 84.
 Barre, H. W., 793.
 Barrows, D. P., 899.
 Barrows, W. B., 237.
 Barrus, M. F., 648.
 Barry, L. W., 264.
 Barss, H. P., 47, 552.
 Barthel, C., 113.
 Bartlett, A. W., 432.
 Bartlett, H. H., 125, 308.
 Bartlett, H. L., 757.
 Bartlett, J. M., 60, 572.
 Baru, R., 709.
 Bass, 482.
 Bassett-Smith, P. W., 475, 869.
 Bast, T. H., 263.
 Batchelor, H. W., 195.
 Batchelor, L. D., 235.
 Bates, C. G., 738, 779.
 Bates, L. B., 682.
 Bates, M., 33.
 Bateson, W., 900.
 Battye, H. W., 555.
 Bauche, J., 882.
 Baudet, 882.
 Baudisch, H., 287.
 Bauer, F. C., 21.
 Baughman, W. F., 109.
 Baule, B., 318.
 Baur, E., 270.
 Baylis, H. A., 752.
 Bayliss, W. M., 255.
 Beach, B. A., 682.
 Beach, F. F., 204.
 Beach, F. K., 380.
 Beach, J. B., 40.
 Beach, J. R., 600, 778.
 Beals, C. L., 196, 476.
 Beam, A. L., 700.
 Beattie, H. G., 700.
 Beattie, J. H., 139.
 Beattie, W. R., 537.
 Bechdel, S. I., 700.
 Bechtel, J. R., 299.
 Beck, K., 12.
 Becker, J. A., 695.
 Beckman, H. C., 614.
 Beckwith, C. S., 540, 557.
 Bedell, B. H., 821.
 Bedell, H. L., 18, 422.
 Bedford, S. A., 536.
 Bedson, S. P., 762.
 Beeby, G. S., 494.
 Beeson, C. F. C., 560.
 Behre, A., 506, 666.
 Behre, C. E., 644.
 Behre, E. H., 267.
 Behrends, F. G., 891.
 Bélime, E., 84.
 Bell, D. S., 397.
 Bell, P. L., 391.
 Bellis, B., 615.
 Bellows, H. A., 495.
 Beltrami, P., 579.
 Bemelmans, E., 278.
 Benedict, F. G., 260.
 Benedict, H. B., 115.
 Benedict, S. R., 417.
 Bengen, F., 808.
 Bengtson, I. A., 262.
 Benner, J. W., 83.
 Bennetch, P. B., 75.
 Bennett, C. W., 699.
 Bennett, H. C., 238.
 Benson, M., 522.
 Benson, O. H., 95.
 Bensusan, S. L., 791.
 Bent, A. C., 151.
 Benton, T. H., 422.
 Bequaert, J., 356.
 Berg, C. van den, 741.
 Berg, G., 73.
 Bergeln, O., 667, 759.
 Bergman, H. F., 632.
 Bernard, N., 882.
 Berridge, E. M., 44.
 Berry, E. W., 521.
 Berry, J. B., 896.
 Berry, R. A., 677.
 Bertrand, G., 667.
 Besley, F. W., 86, 842.
 Besredka, A., 375.
 Betelle, J. O., 94.
 Betts, G. H., 95.
 Bevan, E. J., 68.
 Bevan, L. E. W., 880.
 Bewley, W. F., 124, 447, 543.
 Bexell, J. A., 291.
 Bezssonof, N., 127.
 Bezssonoff, N., 359, 668.
 Bibbins, A. L., 299.
 Bliermann, 736.
 Biffen, R. H., 741.
 Bigelow, W. D., 561, 681, 754.
 Biggar, H. H., 31.
 Bigger, J. W., 75.
 Biggs, F. C., 585.
 Bijl, P. A. van der, 206, 417, 418, 454, 648.
 Bilbao, F., 591.
 Billings, G. A., 590.
 Billson, H. G., 645.
 Bioletti, F. T., 40, 140, 540.
 Birch, R. R., 83.
 Birge, E., 97.
 Birks, W. R., 545.
 Birmingham, W. A., 546, 551, 746.
 Birt, A. G., 531.
 Bisby, G. R., 346.
 Bishop, C. T., 888.
 Bisset, P., 541.
 Bisson, C. S., 599.
 Bizzell, J. A., 210.
 Bjanos, O. T., 898.
 Black, A. B., 749.
 Black, J. D., 290.
 Black, R. A., 639.
 Black, R. H., 100.
 Black, R. S., 113.
 Black, W. H., 269.
 Blackham, R. J., 879.
 Blackman, F. F., 522.
 Blackman, M. W., 461.
 Blackman, V. H., 431, 523, 528.
 Blackshaw, G. N., 316, 623.
 Blackwell, J. D., 897.
 Blair, A. W., 425, 428, 514, 519, 534, 818.
 Blair, R. J., 382.
 Blair, W. G., 133, 635.
 Blake, S. F., 644, 721.
 Blakeslee, A. F., 27, 575.
 Blanchard, E., 44.
 Blanchard, F. S., 730.
 Blanck, E., 518, 572, 620, 621, 638.
 Blaringhem, L., 32.
 Blasingame, R. U., 100.
 Blatherwick, N. R., 74.
 Bledisloe (Lord), 391.
 Blichfeldt, S. H., 13.
 Blicke, 882.
 Blish, M. J., 269, 396, 795.
 Bloor, W. R., 861.
 Blount, B., 778, 888.
 Bloxam, A. G., 778.
 Blunt, A. W., 238.
 Blunt, K., 166.
 Boas, I. H., 114.
 Bobiloff, W., 43, 737.
 Bobko, E., 718.
 Bodansky, M., 111, 260, 566, 861.
 Bodenheimer, F., 798.
 Boerner, F., jr., 482, 485.
 Böhrling, F. R., 400.
 Bokorny, T., 224.
 Bokura, U., 244.
 Bolding, I., 736.
 Bolley, H. L., 134.
 Bolling, G. E., 174, 175.
 Bonacina, L. W. C., 115.
 Bonar, L., 743.
 Bondy, F. F., 751.
 Bone, H. A., 93.
 Bonnet, L. O., 540.
 Bonnier, G., 463.
 Booth, W. H., 729.
 Boothby, W. M., 260.
 Boquet, A., 376, 581.
 Borden, A. D., 160.
 Bórea, D., 592.
 Borghesani, G., 41.

- Bornemann, 818.
 Borries, G., 416.
 Borthwick, J. D., 881.
 Boscawen, A. G., 398.
 Bose, A. K., 812.
 Bose, J. C., 528.
 Boshnakian, S., 333.
 Ross, A., 389, 493.
 Bosworth, A. W., 261, 862, 863.
 Botjes, J. G. O., 147.
 Botkin, C. W., 97.
 Bottomley, A. M., 442.
 Bottomley, W. B., 799.
 Boulenger, C. L., 485.
 Bouquet, A. G. B., 838.
 Bourlet, C. W., 614.
 Bourne, A. I., 38, 50.
 Bourne, B. A., 647.
 Bouska, F. W., 97.
 Boutwell, P. W., 257.
 Bouvier, E. L., 851.
 Bovell, J. R., 534.
 Böving, A. G., 354, 857.
 Bowie, E. H., 618.
 Bowley, A. L., 593.
 Bowman, I., 697.
 Boyd, G. R., 85.
 Boyden, B. L., 462.
 Boyle, J. E., 594.
 Brackett, R. N., 124.
 Bradford, F. C., 337.
 Bradley, A. B., 507.
 Brandis, U. von, 437.
 Branford, R., 685.
 Brannon, J. M., 628.
 Branson, E. C., 89.
 Brasher, R. I., 456.
 Brauns, D. H., 109.
 Bray, G. T., 108.
 Bray, S., 677.
 Breakwell, E., 33, 638.
 Breeze, M. S. G., 842.
 Breithaupt, 437.
 Brechley, W. E., 132.
 Brewster, J. F., 508.
 Brierley, W. B., 454.
 Brierley, W. G., 539.
 Briganti, G., 92.
 Briggs, G., 440, 715, 725, 733, 748.
 Briggs, G. E., 523.
 Brimhall, S. D., 686.
 Brimley, C. S., 460.
 Brink, R. A., 437.
 Brioux, C., 715.
 Bristow, E. A., 35.
 Brittain, W. H., 51, 248.
 Brittlebank, C. C., 451.
 Britton, W. E., 340.
 Brock, J. A., 450.
 Brocq-Roussen, 885.
 Brody, S., 371, 771.
 Brolli, J., 834.
 Bronfenbrenner, J., 64, 361, 669, 670.
 Brooks, A., 456.
 Brooks, C., 149, 452.
 Brooks, C. E. P., 314.
 Brooks, F. E., 249.
 Brooks, F. T., 860.
 Brooks, W. P., 196.
 Brotherton, W., jr., 37.
 Brown, A. L., 76.
 Brown, A. S., 837.
 Brown, B. A., 835.
 Brown, E. (England), 768, 875.
 Brown, E. (U. S. D. A.), 732.
 Brown, E. B., 532, 827.
 Brown, G. A., 478.
 Brown, G. G., 234.
 Brown, H. B. (Canada), 536.
 Brown, H. B. (Miss.), 396, 532, 729.
 Brown, H. G., 894.
 Brown, H. L., 298.
 Brown, J. C., 97.
 Brown, J. H., 180, 708.
 Brown, L. S., 97.
 Brown, N. A., 150.
 Brown, P. E., 518.
 Brown, S. M., 421.
 Browne, C. A., 205.
 Bruce, A. A., 292.
 Bruce, D., 342, 739.
 Brues, C. T., 246.
 Bruhns, G., 506, 507.
 Brumley, O. V., 276.
 Brumpt, E., 882.
 Brunkow, O. R., 502.
 Brunner, E. de S., 89.
 Bruno, A., 500.
 Brunskill, E., 555.
 Bruynoghe, R., 578.
 Bryce, G., 747.
 Bryson, T. A., 614.
 Bücher, H., 657.
 Bucholtz, F., 239.
 Buckell, E. R., 748.
 Buckmire, E., 194.
 Buckner, G. D., 876.
 Buell, J., 695.
 Buell, M. V., 61.
 Bugge, G., 881.
 Bull, C. G., 775.
 Bull, L. B., 184.
 Bunnell, C. E., 298.
 Bunnemeyer, B., 618.
 Bunyard, E. A., 839.
 Burchard, E. D., 778.
 Burger, O. F., 651.
 Burgerstein, A., 224.
 Burgest, S. van, 51.
 Buri, R., 882.
 Burke, E., 314, 316.
 Burke, G. S., 262, 763.
 Burke, H. E., 750, 856.
 Burkhardt, F., 51.
 Burns, A. T., 191.
 Burns, R. H., 97.
 Burns, W., 640, 735.
 Burr, A., 275, 276.
 Burr, S., 37.
 Burr, W., 496.
 Burt, B. C., 638, 833.
 Burwash, A. H., 512.
 Busck, A., 856.
 Buston, H. W., 802.
 Butler, T., 299.
 Butterfield, K. L., 89, 799.
 Butters, M., 396.
 Buttrick, P. L., 645.
 Buxton, J. B., 773.
 Buxton, P. A., 558, 559.
 Byars, L. P., 145.
 Caesar, L., 248.
 Calazans, S. C., 670.
 Caldwell, J. S., 616.
 Caldwell, M. L., 708.
 Caldwell, W. A., 736.
 Caldwell, W. H., 175.
 Call, L. E., 30.
 Calmette, A., 581.
 Calvin, J. W., 171.
 Cameron, J., 72.
 Camp, A. F., 244.
 Camp, W. R., 694.
 Campbell, A. A., 614.
 Campbell, H. C., 585.
 Campbell, H. L., 667, 865.
 Campbell, J. A. C., 572.
 Campbell, R. C., 614.
 Campbell, R. E., 856.
 Campbell, R. H., 141.
 Campus, A., 259.
 Canals, E., 310.
 Cannon, P. R., 666.
 Cannon, W. A., 25, 27.
 Capone, G., 636.
 Carapezza, L., 221.
 Caray, E. M., 803.
 Card, L. E., 396, 575, 600, 769.
 Cardon, P. V., 327.
 Carey, E. J., 262.
 Carle, 84.
 Carlson, K. A., 445.
 Carlyle, S. G., 289.
 Carman, A. P., 381.
 Carne, W. M., 742.
 Carnes, N. K., 271.
 Carney, M., 89.
 Carpenter, C. W., 347, 647.
 Carpenter, D. W., 899.
 Carpenter, G. H., 456.
 Carpenter, P. H., 520, 811, 812.
 Carr-Saunders, A. M., 766.
 Carré, H., 375, 377, 579, 777.
 Carrier, L., 874.
 Carrier, W. H., 12.
 Carroll, M., 557.
 Carroll, C. E., 296.
 Carter, H. R., 134.
 Carter, L. M., 17, 712

- Carter, R. A., 196.
 Carter, W. E., 562.
 Carver, G. W., 730.
 Carver, T. N., 590.
 Cary, C. A., 74, 182.
 Casale, L., 621.
 Casoria, M., 895.
 Caspari, W., 671.
 Casserly, T. L., 180.
 Castello, W. O., 627.
 Castle, W. E., 573.
 Cathcart, E. P., 563.
 Cathcart, P. H., 413.
 Catoni, L. A., 553, 558.
 Cauchemez, 885.
 Caudell, A. M., 559.
 Caullery, M., 655.
 Caum, E. L., 346.
 Chace, E. M., 140.
 Chadwick, H. D., 869.
 Chakravarty, J. N., 531.
 Chambers, F., 685.
 Chambers, H., 129.
 Chambers, W. H., 324, 772.
 Chamot, É. M., 201.
 Champlain, A. B., 857.
 Chancercel, L., 221.
 Chandler, A. C., 49.
 Chandler, W. H., 3, 129.
 Channer, F. F. R., 645.
 Chapin, R. M., 14.
 Chapman, G. H., 651.
 Chapman, H. H., 341.
 Chapman, R. W., 382.
 Charlan, F., 836.
 Charles, T. B., 778.
 Charmoy, D. d'E. de, 559.
 Charron, A.-T., 772.
 Chase, A., 721.
 Chaudet, A., 269.
 Chaudhury, N. C., 533.
 Chenoweth, W. W., 60.
 Cheplin, H. A., 870.
 Chesnut, V. K., 202, 207.
 Chevalier, A., 337, 721.
 Chevallier, A., 205.
 Chick, H., 568, 868.
 Chiffot, J., 240.
 Childs, R. R., 830.
 Ching, K. A., 623.
 Chittenden, A. K., 542.
 Chittenden, D. W., 363.
 Chittenden, F. J., 238.
 Chopard, C., 851.
 Choudhury, H. P., 344.
 Christian, H. B., 817.
 Christie, A. W., 509.
 Christmas, W. D., 314.
 Chudeau, A., 84.
 Chung, H. L., 632.
 Church, A. H., 524.
 Church, C. G., 140.
 Church, L. M., 87.
 Church, M. B., 224, 431.
 Ciamician, G. L., 324, 599.
 Claassen, P. W., 465.
 Clapp, E. H., 41.
 Claremont, C. L., 455.
 Clark, E. P., 10, 308.
 Clark, E. T., 739.
 Clark, F. H., 897.
 Clark, F. R., 899.
 Clark, G. H., 443.
 Clark, J. A., 136.
 Clark, M. B., 425.
 Clark, R. W., 696.
 Clarke, I. D., 114.
 Clarkson, W. B., 99.
 Clawson, A. B., 280.
 Claxton, P. P., 896.
 Clayton, E. E., 749, 899.
 Cleghorne, W. S. H., 585.
 Clement, C. E., 175.
 Clements, E. S., 28.
 Clements, F. E., 27, 28, 29, 209.
 Clemmer, H. F., 86, 87.
 Clevenger, J. F., 308.
 Close, C. P., 537.
 Clothier, R. W., 679.
 Clough, H. W., 618.
 Clow, T., 260.
 Clute, R. L., 193.
 Clutterbuck, P. H., 238.
 Coad, B. R., 751.
 Coates, L., 841.
 Cobb, N. A., 461.
 Cockayne, L., 142, 222, 542.
 Coelho de Souza, W. W., 229.
 Coffey, D., 895.
 Coffey, G. N., 699.
 Coker, D. R., 729.
 Colby, A. S., 552.
 Cole, H. S., 115.
 Cole, J. S., 130.
 Cole, W. R., 386.
 Colebatch, W. J., 131.
 Coleman, F. F., 838.
 Coll y Toste, C., 837.
 Colle, 722.
 Collier, G. A., 129, 130, 228.
 Collin, E., 311.
 Collins, C. W., 893.
 Collins, J. F., 150.
 Collins, J. L., 223, 721.
 Collins, W. O., 17, 712.
 Collison, R. C., 423.
 Colón, E. D., 796.
 Comber, N. M., 615.
 Cominotti, L., 277.
 Congdon, L. A., 807.
 Coni, E. A., 593.
 Conn, H. J., 317, 431.
 Conn, J. H., 391.
 Connaway, J. W., 377, 378, 379.
 Connell, I., 595.
 Conner, S. D., 120.
 Connors, C. H., 536.
 Converse, P. D., 594.
 Cook, F. C., 324.
 Cook, H. O., 444.
 Cook, K. M., 294.
 Cook, L. B., 175.
 Cook, L. J., 699.
 Cook, M., 179.
 Cook, M. T., 322, 529, 547, 548.
 Cook, O. F., 439, 595, 834.
 Cooledge, L. H., 175, 479.
 Cooley, A. M., 296.
 Cooley, R. A., 59, 555.
 Coons, G. H., 448.
 Cooper, E., 567.
 Cooper, G. D., 236.
 Cooper, T., 898.
 Cooper, W. S., 27.
 Copaux, H., 415.
 Copland, D. B., 731, 788.
 Coppetti, V., 805.
 Corbett, G. H., 559.
 Corbould, M. K., 394, 665.
 Cordes, W. A., 76.
 Cordley, A. B., 698.
 Córdova, R. G., 592.
 Corkins, C. L., 153.
 Corlette, C. E., 561.
 Coronas, J., 618.
 Corporaal, J. B., 159.
 Correns, C., 721.
 Cory, E. N., 748.
 Costa, M., 636.
 Cotton, A. D., 848.
 Cotton, E. C., 750.
 Couret, M., 884.
 Cousins, C. W., 696, 895.
 Covault, C. H., 686.
 Covell, M. R., 173.
 Coventry, B. O., 541.
 Covert, R. N., 688.
 Coville, F. V., 140, 225, 235.
 Cowan, P. R., 162.
 Coward, K. H., 64, 356, 357, 565, 680.
 Coward, T. A., 151.
 Cowdry, N. H., 29.
 Cowell, A. W., 700.
 Cowgill, G. R., 358, 760.
 Cox, H. R., 530.
 Cox, J. F., 598, 633.
 Cox, W. T., 237.
 Crabtree, J., 620.
 Craig, J. F., 778.
 Craighead, F. C., 353.
 Cramer, 223.
 Cramer, W., 62, 867.
 Cramp, W., 689.
 Crampton, H. E., 748.
 Crawford, J. C., 254.
 Crawley, H., 59, 685, 777.
 Crawley, W. C., 752.
 Creelman, G. C., 844.
 Crerar, T. A., 894.
 Crim, R. C., 699.
 Crisler, O. S., 379.
 Crockett, H. G., 313.
 Crohurst, H. R., 491.
 Cross, C. F., 9, 68.

- Cross, H. E., 777, 778, 881.
 Cross, W. E., 135, 535.
 Crossley, A. W., 730.
 Crosthwait, D. N., jr., 386.
 Crow, J. W., 800.
 Crowther, C., 633.
 Cruess, W. V., 163, 208, 509.
 Crum, R. W., 487.
 Cullinan, F. P., 128.
 Culpepper, C. W., 663.
 Cummings, R. H., 75.
 Cummings, M. B., 138.
 Cunliffe, N., 53, 158.
 Cunningham, C. C., 30.
 Cunningham, O. C., 135, 169, 173.
 Curasson, G., 580.
 Curtis, A. J. R., 100.
 Curtis, H. E., 322.
 Curtis, R. S., 269.
 Curtiss, C. F., 394.
 Cushman, J. A., 521.
 Cushman, R. A., 254, 464, 857.
 Cutting, E. M., 529.

 Dabney, T. E., 138.
 Dachnowski, A. P., 317.
 Dadisman, A. J., 191.
 Dadisman, S. H., 199, 393.
 Dahlberg, E. C., 732.
 Dahmen, H., 774.
 D'Albuquerque, J. P., 534.
 Dalling, T., 776.
 Dalrymple-Hay, R., 843.
 d'Alviella, F. G., 42.
 Dalyell, E. J., 568, 868.
 Damjanovich, H., 760.
 Damon, S. R., 760.
 Dana, R. T., 888.
 Dangeard, P., 723.
 Dangeard, P. A., 724.
 d'Angremond, A., 252.
 Daniel, L., 720.
 Daniels, A. L., 759.
 Daniels, A. M., 386.
 Danysz, J., 374.
 Darlow, A. E., 72.
 Darnell-Smith, G. P., 453, 745, 846.
 Darrow, G. M., 642.
 Darrow, W. H., 39.
 Darwin, F., 434.
 Das, S., 121.
 Dash, J. S., 398.
 Dastur, J. F., 743.
 Daumézou, G., 44.
 D'Aunoy, R., 181.
 Davenport, C. B., 27.
 Davenport, E., 499, 702, 705, 794.
 Davenport, S. L., 842.
 David, 774.
 Davidson, I., 896.
 Davidson, J. (Canada), 843.
 Davidson, J. (England), 246.
 Davidson, J. B., 98, 100.

 Davis, C. E., 258.
 Davis, D. I., 491.
 Davis, D. J., 80, 97.
 Davis, J. J., 53, 458.
 Davis, M. B., 234.
 Davis, W. H. (Cedar Falls, Iowa), 449.
 Davis, W. H. (Pa.), 198, 700.
 Davison, F. R., 553.
 Davison, W. C., 571.
 Day, J. W., 94.
 Day, V. S., 692.
 Day, W. F., 795.
 de Almeida, A. O., 671.
 Deam, C. C., 237.
 Dean, H. H., 772.
 de Angelis d'Ossat, G., 627.
 Dearing, C., 40.
 de Charmoy, D. d'E., 559.
 De Decker, G., 571, 572, 870.
 Dědek, J., 312.
 Deem, J. W., 793.
 De Fosset, A. J., 182.
 de Joannis, J., 660.
 Delacre, M., 202.
 de la Torre, P., 535.
 de Layens, G., 463.
 de Mérejkovsky, C., 722.
 d'Emmerz de Charmoy, D., 559.
 De Mott, W. H., 459.
 Demuth, G. S., 254.
 Denaiffe, 722.
 Denain, 84.
 Dendinger, W. C., 183.
 Deneumostier, C., 392.
 Denham, H. J., 41.
 Denis, W., 174.
 Denton, M. C., 257, 259.
 de Ong, E. R., 159, 160, 537, 853.
 Derflinger, E. R., 482.
 Derleth, C. P., 614.
 Dernby, K. G., 683.
 Derthick, F. A., 397.
 Descazeaux, 83.
 de Souza, W. W. C., 229.
 Desvergnés, L., 13.
 Detjen, L. R., 639, 651.
 Detlefsen, J. A., 268.
 Detwiler, S. B., 850.
 Deutschland, A., 67, 68.
 De Vine, B., 183.
 de Vogué, L., 894.
 de Vries, O., 43.
 DeWolf, F. W., 381.
 Deysher, E. F., 803.
 Dickerson, E. L., 656.
 Dickey, G. D., 314.
 Dickson, B. T., 847, 849.
 Dickson, E. C., 262, 763.
 Dickson, J. G., 240.
 Dicorato, G., 456.
 Diehl, G. B., 619.
 Dietrich, W., 67, 68.
 Dieudonné, A., 880.
 Digges, D. D., 836.

 Diggs, J. C., 782.
 Dikmans, G., 281.
 Dill, D. B., 466.
 Dimmitt, J. S., 757.
 Dinsmore, W., 99.
 Dixon, H. M., 892.
 Djebaroff, I. A. T., 30.
 Dobbs, A. C., 227.
 Dodd, A. P., 559.
 Dodd, S., 281, 775.
 Dodson, L. S., 369.
 Dofflein, F., 560.
 Doidge, E. M., 453.
 Domville-Fife, C., 789.
 Don, J., 892.
 Dongé, E., 456.
 Donham, S. A., 96.
 Donk, M. G., 312.
 Donovan, R. L., 299.
 Doolittle, R. E., 228, 571.
 Dop, Louis-, 208, 590.
 Doran, W. L., 653.
 Dorph-Petersen, K., 36, 37.
 Dorsey, M. J., 396.
 d'Ossat, G. de A., 627.
 Dougan, W., 496.
 Douglas, C., 595.
 Douglas, H. P., 89.
 Douglass, A. E., 27.
 Douglass, E. W., 463.
 Dowell, A. A., 874.
 Down, E. E., 132, 535.
 Downes, W., 159.
 Downing, P., 795.
 Downs, A. W., 760.
 Downs, P. A., 274.
 Doyer, L. C., 241.
 Doyle, C. B., 833, 834.
 Doyle, K. D., 282.
 Doyle, L. P., 582.
 Doyle, T. M., 685.
 Drake, E. F., 487, 886.
 Drew, A. H., 62, 867.
 Droogleever Fortuyn, A. B., 880.
 Drummond, J. C., 62, 64, 259, 356, 357, 565, 567, 568, 680.
 Dryden, J., 171.
 Dubin, H. E., 759.
 Du Bois, E. F., 260.
 DuBois, R., 877.
 Ducellier, L., 140.
 Ducomet, V., 654.
 Dudley, J. E., jr., 153.
 Duerden, J. E., 573.
 Duffee, F. W., 890.
 Dufrenoy, J., 244.
 Dugger, B. M., 26, 324.
 Duley, F. L., 315.
 Dumez, A. G., 178.
 Dunlavy, H., 833.
 Dunlop, J. Y., 94.
 Dunn, J. E., 213.
 Dunn, L. C., 769.
 Dunn, L. H., 682.
 Dunnewald, T. J., 511.
 Dunstan, M. J. R., 791.

Dupont, P. R., 40, 454.
 du Prey, L., 497.
 Durant, A. J., 377, 378, 379.
 Durham, G. B., 27, 268, 826.
 Durling, V. D., 51.
 Durrant, J. H., 558.
 Durrell, L. W., 144, 743.
 du Sablon, M. L., 126.
 Dusham, E. H., 249.
 Dustan, A. G., 51.
 Dutcher, R. A., 271, 469, 864
 du Toit, H. S., 227, 442.
 Dutton, W. C., 552.
 Duval, C. W., 884.
 Dyar, H. G., 661.
 Dye, H. W., 299.
 Dye, M., 166.
 Dykes, W. R., 842.
 Dymond, J. R., 732.
 Dyrenforth, 418.

Ealand, C. A., 456.
 Earle, F. S., 550, 835.
 Earle, H. G., 260.
 Earnshaw, F. L., 151.
 Easterby, H. T., 836.
 Easterwood, H. W., 718.
 Eastham, J. W., 143.
 Ebert, 39.
 Eckenbrecher, C. von, 831.
 Eckl, K., 319.
 Eckles, C. H., 97.
 Eddy, C. W., 177.
 Eddy, E. D., 232.
 Eddy, H. P., 283, 891.
 Eddy, N. B., 760.
 Eddy, W. H., 164, 256.
 Edgerton, C. W., 145, 344,
 849.
 Edler, G. C., 137.
 Edmond, H. D., 794.
 Edmonds, J. L., 369, 677.
 Edmondson, R. B., 361.
 Edquist, A. G., 323.
 Edson, H. A., 146.
 Edwardes, V. P., 808.
 Edwards, C. W., 763, 793.
 Edwards, J. T., 483.
 Eggleston, W. W., 281.
 Ehrhorn, E. M., 244, 457.
 Eichwald, E., 560.
 Eisler, M., 449.
 Ekblaw, K. J. T., 491.
 Ekmann, O., 239.
 Elfving, F., 225.
 Eliot, H. M., 493.
 Ellinger, T., 73, 268.
 Ellington, E. V., 300.
 Elliott, C. G., 381.
 Elliott, E. C., 899.
 Elliott, F. A., 340.
 Elliott, G. R. B., 185.
 Ellis, A. F., 21.
 Ellis, C., 87.
 Elveden (Viscount), 398.
 Elwell, J. A., 814.

Ely, R. T., 191, 289.
 Embden, G., 415.
 Emberger, L., 824.
 Embleton, D., 181.
 Emerson, P., 806.
 Emmerez de Charmoy, D. d',
 559.
 Emmett, A. D., 864.
 Emoto, O., 900.
 Endres, M., 693.
 Engelbert, E. E., 388, 786.
 Engelmann, 219.
 Engels, 820.
 Engler, A., 141.
 Enslin, B. G. L., 873.
 Epple, W. F., 205.
 Erdman, L. W., 719.
 Ernest, L. B., 881.
 Eshleman, C. H., 618, 619.
 Espino, R. B., 629.
 Espy, 418.
 Essig, E. O., 238, 852.
 Estiot, P., 456.
 Esty, J. R., 413.
 Etheridge, W. C., 326, 331,
 546.
 Etter, A. F., 640.
 Euler, H. von, 9, 866.
 Evans, A. C., 804.
 Evans, F. R., 803.
 Evans, G., 491.
 Evans, I. B. P., 227, 544, 652.
 Evans, P., 297.
 Evans, S. C., 599.
 Evenson, O. L., 176.
 Everett, H. F., 288.
 Evers, N., 614.
 Everts, W. P., 89.
 Evvard, J. M., 73, 386.
 Ewbank, R. B., 895.
 Ewing, H. E., 161, 255, 465,
 752.
 Ewing, S., 811.
 Eyer, J. R., 662, 744.
 Ezendam, J. A., 71.
 Faber, H., 227.
 Fabian, F. W., 413.
 Fabyan, M., 485.
 Fagerstrom, M., 116.
 Fahrion, W., 613.
 Fairgrieve, J., 295.
 Falconer, J. I., 389, 394.
 Fales, H. A., 111.
 Fales, H. L., 756.
 Farley, A. J., 536.
 Farley, F. W., 269.
 Farr, C. H., 338.
 Farrell, F. D., 498.
 Farrell, G. E., 393.
 Fauchère, A., 32.
 Faull, J. H., 41, 348, 454,
 739.
 Faurot, F. W., 140, 297.
 Fawcett, H. S., 149, 244,
 651.

Fawcett, W., 222.
 Feeney, C. M., 562.
 Feldstein, L., 11.
 Felt, 253.
 Fenton, F. A., 549.
 Fenton, F. C., 99.
 Ferguson, B., 197.
 Ferguson, M., 669.
 Fergusson, S. P., 115.
 Fernald, H. T., 50, 152.
 Ferraz, S., 599.
 Ferris, G. F., 246.
 Ferris, L. W., 176.
 Fetherolf, N. J., 447.
 Feytaud, J., 656, 851.
 Field, E., 664.
 Fife, C. D., 789.
 Fildes, P., 79.
 Finch, E. E., 614.
 Findlay, G. M., 64, 474, 669.
 Finks, A. J., 564.
 Finlow, R. S., 32, 131.
 Fippin, E. O., 220.
 Firkins, B. J., 320.
 Fischer, A. F., 645.
 Fischer, C. E. C., 238.
 Fischer, G., 188.
 Fischer, H., 485, 715, 720.
 Fisher, D. F., 452.
 Fisher, E. A., 811.
 Fisher, G., 296.
 Fisher, K., 697.
 Fisher, L. M., 460.
 Fisher, P., 397.
 Fisher, R. A., 137.
 Fisher, R. T., 444, 842.
 Fisher, W. L., 219.
 Fisher, W. S., 461, 661.
 Fishwick, V. C., 226.
 Fiske, J. G., 137.
 Fitch, C. L., 32.
 Fitch, C. P., 633, 886.
 Fitting, F. W., 195.
 Fitzpatrick, H. M., 344.
 Flack, E. V., 320, 520.
 Flebut, A. J., 658.
 Fleischmann, W., 73.
 Fleischner, E. C., 775.
 Fleming, R. S., 12.
 Flenner, A. L., 810.
 Fletcher, L. J., 100.
 Fletcher, S. W., 841.
 Flint, E. R., 598.
 Flint, O. L., 196.
 Flohr, L. B., 290.
 Florence, L., 853.
 Florin, R., 39.
 Flossfeder, F. C. H., 540.
 Fluke, C. L., jr., 53.
 Flury, P., 237.
 Foedisch, F., 437.
 Foex, E., 44, 649.
 Fogle, F. E., 588.
 Foot, N. C., 485.
 Forbell, B., 700.
 Forbes, R. D., 399.

- Forbes, R. H., 798.
 Forbes, S. A., 157.
 Forbush, E. H., 245, 349, 456.
 Ford, A. L., 380, 657.
 Forgeot, P., 774.
 Forsberg, L., 533.
 Fortuyn, A. B. D., 880.
 Foster, A. C., 740.
 Foster, L., 135, 169, 173.
 Foster, W. A., 99.
 Fowler, C. C., 666.
 Fox, C. E., 700.
 Fox, C. R., 492.
 Fox, H. D., 364.
 Frame, B. H., 387.
 Francis, E., 151, 152, 662, 663.
 Frank, A., 449.
 Frank, W. L., 832.
 Fränkel, S., 204.
 Franklin, H. J., 52.
 Fraps, G. S., 124.
 Fraser, H., 484.
 Fraser, J. G. C., 438.
 Frazier, R. D., 115.
 Frazier, W. C., 19.
 Frear, W., 23, 197.
 Freckman, W., 437.
 Fred, E. B., 19, 208, 502, 503.
 Free, E. E., 25.
 Freear, K., 176.
 Freeborn, S. B., 856.
 Freeman, H. A., 136, 817, 836.
 Freeman, J. E., 99.
 Frei, W., 579.
 French, G. T., 732.
 Frenkel, 720.
 Fresenius, L., 503.
 Fresenius, T. W., 111.
 Frey, R. W., 114.
 Fricks, L. D., 460.
 Friebe, 438.
 Friederichs, K., 51, 559.
 Fries, J. A., 70.
 Fries, K. A., 412.
 Friese, J. F., 287.
 Frison, T. H., 463.
 Frissell, S. D., 595.
 Fritsch, F. E., 524.
 Fritsch, J., 518.
 Froboese, J., 415.
 Froggatt, J. L., 751.
 Froggatt, W. W., 155, 559, 661.
 Froidevaux, J., 12.
 Fromme, F. D., 243, 648.
 Fronda, F. M., 600, 769, 870.
 Frost, S. W., 749.
 Frost, W. D., 97, 175.
 Frothingham, E. H., 900.
 Fruwirth, C., 29, 129, 430, 829.
 Frysinger, G. E., 792.
 Fuertes, L. A., 456.
 Fujioka, M., 644.
 Fujiwhara, S., 618.
 Fulghum, J. A., 134.
 Fullaway, D. T., 52, 58.
 Fülleborne, 882.
 Fuller, C., 245.
 Fuller, G. D., 141, 432.
 Fuller, J. M., 273.
 Funk, C., 759, 864.
 Fürth, O., 758.
 Gabriel, R. H., 91.
 Gaget, J., 548.
 Gahan, A. B., 254, 857.
 Gaiger, S. H., 776.
 Gail, F. W., 445.
 Gain, A., 720.
 Gain, E., 720.
 Gaines, R. C., 751.
 Galpin, C. J., 89.
 Gamalielson, J. E., 679.
 Gamble, C. A., 205.
 Gamble, J. A., 174.
 Gándara, G., 546, 553.
 Gandía Córdova, R., 592.
 Garber, R. J., 545.
 Garcia, F., 394.
 Garcia, Osés, R., 31.
 Gard, 653.
 Gardner, F. D., 427.
 Gardner, H. A., 325.
 Gardner, M. W., 147, 148.
 Gardner, V. R., 335.
 Garelli, F., 626.
 Garman, H., 57, 157, 462.
 Garman, P., 154, 431, 753.
 Garrad, G. H., 226, 295, 879.
 Garratt, G. A., 598.
 Garrett, F. W., 315, 712.
 Garrigues, A., 322.
 Garrison, H. S., 532.
 Garrison, P. E., 762.
 Gaskill, E. F., 19.
 Gatenby, J. B., 173.
 Gater, G. H., 897.
 Gates, E., 418.
 Gates, R. R., 524.
 Gatin, C.-L., 723.
 Gäumann, E., 545, 829.
 Gay, E., 115.
 Gehlsen, C. A., 143, 737.
 Gehring, A., 321.
 Geiger, J. C., 262.
 Geilmann, W., 517, 623.
 Gentil, L., 712.
 Gericke, W. F., 629.
 Gerlach, 424, 637, 822.
 Gernert, 229.
 Gerry, E., 341.
 Gerstung, F., 254.
 Getty, R. E., 441.
 Getzloe, L. C., 396.
 Ghosh, D. N., 93.
 Gianoli, G., 718.
 Gibbs, W. M., 686.
 Gibson, A., 153.
 Gierisch, W., 68.
 Giese, C., 883.
 Gilchrist, D. A., 726.
 Gilin, 853.
 Gill, W., 541.
 Gillespie, L. J., 110.
 Gillett, H. J., 888.
 Gillette, H. P., 888.
 Gilliatt, F. C., 51.
 Gilman, H. L., 882.
 Gilmer, P. M., 700.
 Gilmour, G. Van B., 13.
 Giltner, L. T., 361.
 Ginsburg, S., 631.
 Girola, C. D., 635.
 Givens, M. H., 359.
 Gladwin, F. E., 642.
 Glaser, R. W., 246.
 Glasgow, R. D., 457.
 Glattfeld, J. W. E., 26.
 Glendining, B., 876.
 Glöckner, 776.
 Gloyer, W. O., 732.
 Gobert, L., 311.
 Goco, A., 457.
 Goddard, C. E., 879.
 Goding, H., 281.
 Goebel, K., 224.
 Goessmann, 395.
 Goheen, J. L., 577.
 Goke, A. W., 422.
 Goldbeck, A. T., 285.
 Golding, J., 64.
 Goldman, E. A., 456, 655.
 Gomes, 882.
 Gongwer, R. E., 171.
 González, P., 48.
 González Retuerta M., 136.
 Good, E. S., 71, 367.
 Goodall, J. S., 260.
 Goodearl, G. F., 900.
 Goodrich, E. S., 558.
 Gorbea Plá, M., 796.
 Gordon, F. D., 84.
 Gordon, L. S., 91.
 Gordon, N. E., 810.
 Gordon, R. M., 248.
 Gorham, R. P., 51.
 Goss, L. W., 480.
 Goss, R. W., 146.
 Gossard, H. A., 350.
 Goucher, E., 235.
 Gough, G. C., 550.
 Gouraud, 339.
 Gourley, J. H., 138, 396.
 Gowdey, C. C., 246, 247, 656.
 Gowen, J. W., 173, 841, 872.
 Graber, H. T., 113.
 Grabham, M. C., 859.
 Graebner, P., 843.
 Graevenitz, L. von, 834.
 Graf, J. E., 462.
 Graffin, R., 829.
 Graham, J. C., 273.
 Graham, R., 181, 378.

- Gralka, R., 256.
 Grant, G. M., 766.
 Gräub, E., 180.
 Grawert, 774.
 Gray, H., 563.
 Graybill, H. W., 281, 687.
 Greaves, J. E., 209.
 Greeley, W. B., 541.
 Green, F. E., 784.
 Green, I. H., 258.
 Green, W. J., 793.
 Greene, C. T., 57, 661.
 Greene, E. P., 871.
 Gregg, J. W., 699.
 Grégoire, A., 124.
 Greig, R., 227.
 Gresham, W. D., 897.
 Grettenberger, M. L., 168.
 Gribbon, M. G., 669.
 Griffee, F., 136.
 Griffin, E. L., 178.
 Griffin, F. L., 197.
 Griffin, L., 597.
 Griffith, J., 800.
 Griffith, J. J., 122.
 Griggs, M. A., 612.
 Grimes, J. C., 71.
 Grimes, M., 599.
 Grimes, W. E., 389, 497.
 Grimme, C., 467.
 Grindley, H. S., 504, 505.
 Grinenco, I., 636.
 Gröbler, W., 131.
 Groff, G. W., 235.
 Groot, C., 741.
 Gross, E. G., 65.
 Gross, P., 111.
 Grover, N. C., 381.
 Groves, E. R., 89.
 Groves, H. L., 497.
 Grundtvig, N. F. S., 292.
 Grünhut, L., 416.
 Grunsky, C. E., 380.
 Guastavino, A. L., 423.
 Guberlet, J. E., 685.
 Guengerich, H. W., 499.
 Guerber, 194.
 Guernsey, C. O., 383.
 Gulliani, R., 266.
 Guillion, A., 722, 823, 824.
 Guise, C. H., 42.
 Gundersen, A., 522.
 Gustafson, F. G., 127.
 Guthrie, F. B., 137.
 Guttmacher, A. F., 483.
 Guttmacher, M. S., 483.
 Guyénot, E., 524.
 Guyot, C., 141.
 Haag, I. L., 613.
 Haagner, A., 245.
 Haasis, F. W., 446, 900.
 Hadley, C. H., 661.
 Hadley, F. B., 483.
 Hadlington, J., 273.
 Haenel, K., 51.
 Haenseler, C. M., 554, 629.
 Hagan, W. A., 82, 683.
 Hagmann, 188.
 Haigh, L. D., 66.
 Hailer, E., 374.
 Haines, A. W., 480.
 Haines, G., 199.
 Haines, G. C., 656, 833.
 Halbersleben, D. L., 171.
 Haldane, J. B. S., 769.
 Hale, J. A., 381.
 Haliman, E. T., 482.
 Hall, A. F., 41.
 Hall, C. J. J. van, 343.
 Hall, E. C., 814.
 Hall, F. H., 299, 700.
 Hall, H. M., 42.
 Hall, J. S., 469.
 Hall, M. C., 151, 282, 685, 686.
 Hall, T. D., 514.
 Hall, W., 551.
 Hall, W. H., 395, 794.
 Hall, W. T., 310.
 Halligan, C. P., 443.
 Hallock, E. F., 890.
 Halpin, J. G., 288.
 Hamblin, C. O., 448, 451, 453, 549, 745.
 Hambloch, 437.
 Hamerstadt, W. D., 782.
 Hamilton, C. C., 750.
 Hamilton, S. N., 167.
 Hamilton, T. S., 504, 505.
 Hammans, C. W., 90.
 Hammer, B. W., 76, 77, 97, 804.
 Hammett, F. S., 564.
 Hammond, J., 872.
 Hammond, J. L., 494.
 Hamrick, A. M., 618.
 Hand, I. F., 618.
 Handschin, W. F., 783.
 Hanke, M. C. E., 267.
 Hann, 418.
 Hann, J., 200.
 Hannas, R. R., 877.
 Hansen, D., 327, 364, 764, 767, 793.
 Hansen, R., 514.
 Hanson, F. P., 100.
 Harcourt (Lord), 900.
 Harde, 84.
 Harden, A., 61, 256, 261.
 Hardenbergh, J. G., 686.
 Hardenbergh, W. A., 589.
 Harding, H. A., 97, 175, 373, 578, 772.
 Harding, T. S., 312, 506.
 Hardison, A. C., 598.
 Hardt, 437.
 Hardy, F., 811, 815.
 Hare, H. R., 90, 679.
 Hâri, P., 172, 173.
 Harker, J. A., 425.
 Harlan, H. V., 329.
 Harland, S. C., 31.
 Harler, C. R., 520, 811.
 Harman, J. H., 699.
 Harman, S. W., 299.
 Harmer, P. M., 518.
 Harper, R. M., 213.
 Harreveld, P. van, 441.
 Harrington, G. T., 731.
 Harrington, I. S., 792.
 Harris, 253.
 Harris, A. E., 15.
 Harris, C., 792.
 Harris, F. C., 99, 891.
 Harris, J. A., 27, 575, 825, 826.
 Harris, J. B., 506.
 Harris, W., 276.
 Harrison, F. C., 194.
 Harrison, J. B., 89, 500, 727.
 Harrison, T. J., 791.
 Harrison, W. H., 121.
 Harshaw, H. M., 469.
 Hart, E. B., 469, 566.
 Harter, L. L., 325.
 Hartmann, M., 78.
 Hartwell, B. L., 297, 336.
 Hartwell, G. A., 65.
 Hartwig, A. H., 880.
 Hartzell, F. Z., 351.
 Harukawa, C., 458.
 Harvey, E. J., 857, 858.
 Harvey, F. H., 273.
 Harvey, R. B., 838.
 Harwood, P. M., 75.
 Harzer, P., 267.
 Hase, A., 51.
 Haselhoff, E., 820.
 Haseman, L., 349.
 Hasenbäumer, J., 419.
 Haskell, R. J., 45.
 Haskell, S. B., 96.
 Haslam, T. P., 183.
 Hastings, E. G., 97, 221, 682.
 Hatt, W. K., 86, 186, 187, 285, 688.
 Hauck, C. W., 52.
 Hauten, A. van, 623.
 Haviland, M. D., 154, 463.
 Hawk, P. B., 666, 667, 759, 859.
 Hawker, H. W., 119.
 Hawkins, K., 160.
 Hawkins, L. A., 339.
 Hawley, R. C., 236.
 Hay, R. D., 843.
 Hayes, F., 884.
 Hayes, F. A., 18, 422.
 Hayes, J. B., 288.
 Hayes, W. P., 252.
 Hayne, T. B., 856.
 Hays, F. A., 676.
 Hayward, H. D., 779.
 Haywood, A. H., 135.

- Headden, W. P., 28.
 Headlee, T. J., 52, 555, 557, 661.
 Heald, F. D., 545.
 Heald, H. M., 816.
 Hecht, C. E., 561.
 Hecke, G. H., 599.
 Hecke, L., 447.
 Heckscher, H., 312.
 Hector, G. P., 727.
 Hedgcock, G. G., 150.
 Hedrick, U. P., 839.
 Heft, H. L., 164.
 Heim, F., 230, 635.
 Heimerle, 437.
 Heine, 220.
 Heinicke, A. J., 47.
 Heinrich, C., 856.
 Heitland, W. E., 494.
 Heller, H. H., 773.
 Helm, C. A., 34, 326, 834.
 Helser, M. D., 477.
 Hemmi, T., 239.
 Henderson, R. R., 152.
 Hendrick, J., 811.
 Hendricks, G. P., 191.
 Hendrickson, J. W., 771.
 Hendry, G. W., 835.
 Henke, L. A., 815, 878.
 Henneberg, W., 70.
 Henning, H., 563.
 Henricksen, H. C., 370.
 Henry, A. C., 624.
 Henry, A. J., 115, 688, 779.
 Henry, C., 793.
 Henry, H. H., 732.
 Henry, M., 674.
 Henry, Y., 584.
 Hensel, M. W., 206.
 Hensen, V., 267.
 Herdman, W. A., 558.
 Hering, D. W., 418.
 Herkendorf, Schulte., 881.
 Herman, R. S., 561.
 Hernandez, A., 43.
 Herold, W., 51.
 Herrick, C. A., 458.
 Herrick, G. W., 52.
 Herrmann, F., 734.
 Herschel, W. H., 688.
 Hervey, G. W., 678.
 Heslop, G. G., 582.
 Hess, A. F., 164, 165, 261, 473, 865.
 Hess, W. R., 761.
 Hessling, N. A., 618, 619.
 Hester, E. D., 785.
 Heuser, O., 720.
 Hiam, F., 398.
 Hibbard, B. H., 593, 784, 893.
 Hickey, G. M., 614.
 Hicks, W. H., 878.
 Higginbottom, S., 89.
 Higgins, B. B., 722.
 Hilderbrand, S. F., 157.
 Hiley, W. E., 444, 554.
 Hilgendorf, F. W., 731.
 Hill, A. W., 300.
 Hill, E. B., 598.
 Hill, G. F., 248, 254.
 Hill, J. A., 677.
 Hill, L., 572, 827.
 Hillman, F. H., 732.
 Hills, J. L., 522, 536, 572.
 Hiltner, L., 449.
 Hiltner, R. S., 11.
 Himbury, W. H., 729.
 Hindhede, M., 255.
 Hindmarsh, W. L., 72.
 Hinds, J., 380.
 Hine, W. R., 399.
 Hirst, S., 464.
 Hissink, D. J., 809.
 Hitchcock, A. S., 222.
 Hite, B. H., 199.
 Hoag, E. F., 386.
 Hoard, W. D., 199.
 Hobday, F. T. G., 778.
 Hobson, G., 653.
 Hodgkins, J. R., 82.
 Hodgson, A., 868.
 Hodgson, A. N., 797.
 Hodgson, C. M., 238.
 Hoek, P. van, 93, 597.
 Hoerner, J., 153.
 Hoffman, I. C., 547.
 Hoffmann, M., 719.
 Hoffmann, R., 318.
 Hogan, A. G., 168.
 Hogben, L., 173.
 Hogentogler, C. A., 186, 285.
 Holker, J., 111.
 Holland, E. B., 38.
 Holm, A., 442, 533.
 Holmes, F. S., 233.
 Holmes, M. E., 821.
 Holmes, M. G., 198.
 Holmgaard, J., 545.
 Holmgren, N., 600.
 Holst, E. M., 37.
 Holt, L. E., 756.
 Holt, S. V., 315, 712.
 Holtz, H. F., 216.
 Home, J. H. M., 42.
 Honcamp, F., 572.
 Honda, H., 246.
 Hooker, H. D., jr., 337, 443.
 Hool, G. A., 85.
 Hoole, E. T., 880.
 Hooper, C. H., 233.
 Hooper, C. W., 61.
 Hooper, J., 92.
 Hooper, J. J., 73, 74, 372, 373.
 Hoover, H., 387.
 Hopkins, A. D., 114, 353.
 Hopkins, E. F., 343, 344, 654, 732.
 Hopkins, F. G., 110, 255.
 Hopkins, J. C., 694.
 Hoppert, C. A., 566.
 Hopping, R., 159.
 Horlacher, L. J., 71, 367.
 Hornby, H. E., 484.
 Horne, A. S., 242.
 Horne, W. D., 258.
 Horne, W. T., 238, 244.
 Horner, J. T., 299.
 Horsfall, J. L., 662.
 Horsfall, R. B., 456.
 Horton, P. M., 612.
 Horton, R. E., 618.
 Hostetler, E. H., 808.
 Hotson, J. W., 745.
 Houben, J., 9.
 Houk, I. E., 115.
 Houser, T., 333.
 Houston, D., 772.
 Howard, A., 487, 502, 638, 727, 728.
 Howard, G. L. C., 487, 638, 727, 728.
 Howard, H. E., 245.
 Howard, J. R., 386.
 Howard, L. H., 681.
 Howard, L. O., 852.
 Howard, W. L., 47.
 Howarth, W., 729.
 Howe, F. C., 292.
 Howell, A. H., 245.
 Howell, L. G., 590.
 Howitt, J. E., 226.
 Howland, J., 165, 473.
 Hoyle, R. J., 739.
 Hübenenthal, H., 517.
 Hubert, E. E., 850.
 Hucker, G. J., 177, 431, 479.
 Hockett, H. C., 899.
 Huddleson, I. F., 277, 484, 582.
 Hudig, J., 718.
 Huffman, C. F., 699.
 Hughes, F., 816.
 Hume, E. M., 568.
 Hume, W. F., 816.
 Humphrey, G. C., 74.
 Humphrey, H. B., 145.
 Humphreys, W. J., 618.
 Humphries, A. E., 638.
 Hungerford, J. D., 169.
 Hunneus, R., 149.
 Hunt, C. L., 256, 498, 666.
 Hunt, N. R., 150.
 Hunt, R. E., 273.
 Hunter, A., 770.
 Hunter, A. C., 753.
 Hunter, B., 783.
 Huntoon, D. H., 695.
 Hurd, W. D., 522.
 Hurst, C. C., 842, 876.
 Hussey, L. D. A., 360.
 Hussey, R. E., 615.
 Hutchison, C. B., 331, 396.
 Hutchinson, H. B., 124, 217.
 Hutton, F. Z., 316.
 Hutton, R. E., 767.
 Hyde, J. H., 491.
 Hyder, N., 833.

- Iguchi, K., 270.
 Illick, J. S., 341, 342, 445.
 Illingworth, J. F., 153, 246, 746.
 Imes, M., 684.
 Irby, L. G., 739.
 Iredale, T., 49.
 Irish, J. H., 755.
 Islip, H. T., 108.
 Itano, A., 412.
 Ivatts, H. E., 770.
 Iverson, G. W., 100.
 Ives, F. W., 396.
 Jack, R. L., 821.
 Jack, R. W., 465.
 Jackman, W. T., 493.
 Jackson, 894.
 Jackson, E. L., 572.
 Jackson, F. H., 285.
 Jackson, H. E., 89.
 Jackson, H. H. T., 455, 456.
 Jackson, H. S., 144.
 Jackson, M. M., 381.
 Jackson, V. G., 132.
 Jacob, A., 425.
 Jacob, M., 299.
 Jacob, W. R. LeG., 238.
 Jacomb, W. J., 563.
 Jaenicke, A. J., 852.
 James, L. G., 84.
 Jameson, A. P., 53.
 Jamieson, G. S., 109.
 Jander, G., 614.
 Janson, A., 434.
 Jarboe, J. H., 618.
 Jarrell, T. D., 114, 187, 205.
 Jarvis, E., 159, 658, 748.
 Jastro, A. A., 599.
 Jefferson, L. P., 695.
 Jenkin, T. J., 129.
 Jenkins, E. H., 312, 318, 322, 332, 394, 522, 598, 697.
 Jenkins, M. T., 794.
 Jenkins, T. J., 240, 624.
 Jennings, A. C., 588.
 Jennison, H. M., 197.
 Jensen, A., 92, 93.
 Jensen, H., 153.
 Jensen, H. O. S., 69.
 Jensen, W. C., 590, 784.
 Jepson, F. P., 245.
 Jepson, W. L., 41.
 Jerrom, J. H. G., 480.
 Jivanna Rao, P. S., 245.
 Joannis, J. de, 660.
 Joest, E., 681.
 Joffe, J. S., 822.
 Johansen, N., 776.
 Johns, C. O., 503, 564.
 Johnson, A. A., 300.
 Johnson, A. G., 240.
 Johnson, E. (Calif.), 233.
 Johnson, E. (England), 146.
 Johnson, E. (Norway), 625.
 Johnson, E. B., 460.
 Johnson, E. C., 896.
 Johnson, W., 812.
 Johnson, J., 333.
 Johnson, J. M., 60, 61.
 Johnson, O. R., 387.
 Johnson, R., 164.
 Johnson, T. C., 335.
 Johnson, W. T., 297, 498.
 Johnston, F. W., 238.
 Johnston, J. F., 175.
 Johnston, T. H., 656.
 Johnstone, J., 466.
 Jolyet, H., 42.
 Jones, A. A., 414.
 Jones, A. S., 661, 682.
 Jones, C. H., 522, 536, 572.
 Jones, C. R., 153.
 Jones, C. W., 771.
 Jones, D. B., 163, 503.
 Jones, E. R., 185, 381.
 Jones, F. R., 124.
 Jones, H. A., 538.
 Jones, H. I., 877.
 Jones, H. M., 861.
 Jones, J., 275.
 Jones, J. S., 732, 805.
 Jones, L. A., 111.
 Jones, L. H., 526, 629.
 Jones, L. R., 345.
 Jones, M. E., 296.
 Jones, M. M., 385.
 Jones, M. R., 259.
 Jordaan, J. J., 876.
 Jordan, H. E., 263.
 Jordan, J. O., 175, 176.
 Jordan, W. H., 698.
 Joshi, K. V., 636.
 Judd, C. S., 42.
 Jull, M. A., 782.
 Jullidière, 84.
 Jumelle, H., 202.
 Jungkunz, R., 416.
 Junk, H., 821.
 Juritz, C. F., 442, 780.
 Jurney, R. C., 815.
 Justin, F., 299.
 Juve, O. A., 493.
 Kagoshima, S., 668.
 Kahn, R. L., 276.
 Kaim, H., 319.
 Kaiser, W. G., 386.
 Kameyama, N., 20, 21.
 Kamm, O., 414.
 Kammlade, W. G., 369, 677.
 Kanehira, R., 143, 542.
 Kantor, L., 485.
 Kappers, C. U. A., 880.
 Karrer, J. L., 325.
 Kato, G., 669.
 Katsufuji, K., 242.
 Kauffman, C. H., 743.
 Kauffman, T. E., 497.
 Kaupp, B. F., 491, 768.
 Kawakita, S., 668.
 Kay, J., 286.
 Keane, P. H., 299.
 Kearney, T. H., 31.
 Keding, F., 513.
 Keeler, R. F., 796.
 Keen, B. A., 88.
 Keenan, W. N., 51.
 Keeney, M. H., 273.
 Kehoe, D., 778.
 Keil, J. B., 336.
 Kellin, D., 57.
 Keith, J. A. H., 193.
 Kelley, F. J., 199.
 Kelley, J. B., 385.
 Kelley, M. A. R., 99, 587.
 Kelley, W. P., 421.
 Kellogg, J. W., 24, 719.
 Kellogg, R. E., 795.
 Kelly, E., 174, 288.
 Kelly, J. P., 723.
 Kelsall, A., 845.
 Kelsner, R. A., 685.
 Kempster, H. L., 370, 385.
 Kempton, F. E., 546.
 Kempton, J. H., 229.
 Kendall, A. I., 179, 880.
 Kendall, J. C., 394.
 Kendrick, J. B., 147, 148.
 Kenety, W. H., 539.
 Kennard, D. C., 768, 782.
 Kennaway, E. L., 113.
 Kerhey, McF., 492.
 Kerr, J. G., 773.
 Kerr, P. J., 479.
 Kertzell, S., 685.
 Kester, R. B., 893.
 Keuchenius, P. E., 747.
 Khaled, Z., 775.
 Kidd, F., 523.
 Kidd, M. N., 860.
 Kidder, F. E., 691.
 Kiessling, L., 531.
 Kilbourne, C. H., 176.
 Kile, O. M., 386.
 Killian, C., 46, 48.
 Killough, H. B., 598.
 Kimball, H. H., 618.
 Kimrey, A. C., 491.
 King, C. V., 267.
 King, F. G., 476.
 King, J. T., Jr., 672.
 King, W. E., 81.
 Kinley, D., 702, 703.
 Kinney, E. J., 33.
 Kirby, A. H., 656.
 Kirkham, V. H., 273.
 Kirkpatrick, W. F., 575.
 Kirkwood, I., 872.
 Kisskalt, K., 78.
 Klein, J., 390.
 Klein, W., 70.
 Kleine, R., 51.
 KleinSmid, R. B. von, 195.
 Klek, J., 463.
 Kligler, I. J., 588.
 Klimmer, M., 70, 178.

- Klopstock, M., 201.
 Kluerter, H., 681.
 Klugh, A. B., 655.
 Knapp, S. A., 296.
 Knibbs, G. H., 695, 895.
 Knight, H. H., 854.
 Knischewsky, O., 792.
 Knoblauch, O., 86.
 Knowles, C. H., 245, 247.
 Knowlton, H. E., 828.
 Knudson, L., 631.
 Kobel, F., 743.
 Koch, L., 230, 232.
 Koch, M. L., 201.
 Kochs, 736.
 Koerner, W. F., 231.
 Kohl, E. J., 456.
 Kohler, D., 723.
 Kohman, E. F., 15, 772.
 Kolb, J. H., 894.
 Kolmer, J. A., 579.
 Kolthoff, I. M., 614, 615.
 Komers, K., 807.
 Kondo, S., 900.
 König, J., 70, 419, 755.
 Kopeloff, N., 681, 710, 862.
 Kopman, H. H., 554.
 Korenchevsky, V., 568.
 Korff-Petersen, 891.
 Korstian, C. F., 447, 900.
 Koser, S. A., 361, 754.
 Kotze, J. J., 42.
 Kowarsky, A., 201.
 Kraemer, H., 41, 223, 224, 897.
 Krafft, G., 29.
 Kraft, A., 440.
 Kramer, B., 165, 203, 416, 417.
 Kranich, F. N. G., 100.
 Krantz, F. A., 346.
 Krarup, C., 220.
 Kraus, E. J., 721.
 Kraus, R., 485, 579.
 Krauss, F. G., 440, 633, 643.
 Kraybill, H. R., 674.
 Krebs, A. W., 109.
 Kreusler, 523.
 Kreuz, A., 437.
 Krieger, L. C. C., 322.
 Krische, P., 815.
 Kriwuschka, A., 172, 173.
 Kroemer, K., 40.
 Krogh, A., 69.
 Krout, W. S., 699.
 Kruckeberg, H. W., 37.
 Krum, W. G., 598.
 Krumwiede, C., 174, 275, 482.
 Krusekopf, H. H., 214, 511.
 Kudo, T., 264.
 Kulkarni, L. B., 30.
 Kulp, W. L., 308, 899.
 Kunkel, L. O., 344, 743.
 Kuo, T. S., 183.
 Küpfer, M., 266.
 Kuramitsu, C., 871.
 Kurtz, W. J., 577.
 Kuwatsuka, K., 243.
 Kuznetsova, E. S., 632.
 Ladd, E. F., 134.
 Lafferty, H. A., 743.
 LaForge, F. B., 710.
 Lahitte, E., 495.
 Laing, F., 153.
 Lake, G. C., 152, 662, 663.
 Lakon, G., 51.
 Lamb, P. H., 437.
 LaMer, V. K., 256, 257, 667, 864, 865, 866.
 Lamkey, E. M. R., 627.
 Lamon, H. M., 272, 500.
 Lancaster, S. P., 41.
 Landis, W. S., 717.
 Lane, C. B., 174.
 Lane, F. Van Z., 890.
 Lane, R. C., 618.
 Lang, H. L., 859.
 Lang, J., 256.
 Lang, R., 219, 619.
 Lange, W., 505.
 Lange, G. A., 640.
 Langfeldt, E., 356.
 Lantow, J. L., 97.
 Lapie, G., 42.
 Larrimer, W. H., 657.
 Larsen, R., 817.
 Larson, C. W., 175.
 LaRue, C. D., 737.
 Lasch, W., 870.
 Lassablière, P., 258.
 Lathouwers, V., 442.
 Lathrop, F. H., 749, 855.
 Laubert, R., 742.
 Laufer, 225.
 Laur, E., 390, 591.
 Lavenir, P., 269, 822.
 Lavett, C. O., 12.
 Lawton, B., 151.
 Lawyer, G. A., 151.
 Layens, G. de, 463.
 Leach, B. R., 251, 252.
 Leake, H. M., 125, 227.
 Leavenworth, C. S., 801.
 Lebailly, C., 376.
 Leclerc du Sablon, M., 126.
 Lecoq, R., 469.
 Lee, A. R., 500.
 Lee, H. A., 46, 347, 745, 652.
 Lee, L., 86.
 Lee (Lord), 398.
 Leefmans, S., 58.
 Leersum, E. C. van, 562, 862.
 Lees, A. H., 38, 39, 460.
 Lees, B., 792.
 Leeuwen, W. S. van, 470.
 LeFevre, E., 355, 502.
 Lefevre, G., 370.
 Legat, C. E., 541, 843.
 Le Grand, L., 311, 807.
 Lehfeldt, R. A., 89.
 Lehmann, E. W., 99.
 Leighton, G., 679.
 Leighty, C. E., 333.
 Leitch, R. H., 772.
 Lek, H. A. A. van der, 451.
 Lemmermann, O., 319, 503, 521.
 Lemmet, J., 584.
 Lengerken, H. von, 51.
 Lentz, J. B., 81.
 Leonard, M. D., 299.
 Leonardi, G., 53.
 Leoncini, G., 825.
 Leplae, 392.
 Lerche, M., 83.
 Lesley, J. W., 126.
 Levene, P. A., 11.
 Levine, C. O., 573, 577, 764.
 Levine, M., 49.
 Lewis, H. B., 757.
 Lewis, H. R., 95, 574, 583, 584.
 Lewis, W. K., 12.
 Lichtenwalner, D. C., 810.
 Lieben, F., 758.
 Lindeman, E. C., 789.
 Lindemann, C., 275, 276.
 Lindemans, 194.
 Lindenbergh, A., 579.
 Lindgren, A. C., 100.
 Lindhard, E., 831.
 Lindsey, A. W., 247.
 Lindsey, J. B., 21, 30, 476.
 Lindskog, G. E., 209, 419, 809.
 Lindstrom, E. W., 794.
 Linfield, F. B., 394.
 Ling, A. R., 112.
 Linossier, G., 276.
 Linton, R. G., 773.
 Lipman, C. B., 812.
 Lipman, J. G., 197, 426, 428, 514, 519, 534, 598, 818, 822.
 Lipschütz, A., 266.
 Lipscomb, J. N., 389, 590.
 List, G. M., 55.
 Little, C. C., 795.
 Little, R. B., 882.
 Littlewood, W., 773.
 Lively, C. E., 97.
 Liverseege, J. F., 807.
 Lizius, J. L., 413.
 Lloyd, F. E., 529.
 Lloyd, L., 53, 458.
 Lloyd, O. G., 783.
 Lloyd, W. A., 94.
 Lockett, S., 377.
 Lockwood, W. P. B., 175.
 Loeb, J., 126, 127, 128, 433.
 Loeb, L., 567, 871.
 Long, A. W., 641.
 Long, C. M., 292.
 Long, D. D., 17, 712.
 Long, F., 29, 42.
 Long, H. D., 732.

- Loomis, R., 390.
 Looss, 882.
 López, F., 796.
 Loree, R. E., 537.
 Lott, R. B., 750.
 Loughlin, G. F., 521.
 Louis-Dop, 208, 590.
 Lounsbury, C., 118.
 Lounsbury, C. P., 153, 442, 662, 748.
 Lovejoy, P. S., 42.
 Lovett, A. L., 57.
 Löwenstein, E., 182.
 Lowry, M. W., 17, 712.
 Lucas, P. S., 699.
 Luckett, J. D., 348.
 Ludlow (Lady), 798.
 Luginbill, P., 658.
 Lumière, A., 721, 813.
 Lund, C. W., 459.
 Lund, Y., 209.
 Lunz, H., 732.
 Lusk, G., 260, 471.
 Lutman, A. S., 536.
 Lutz, F. E., 49, 247.
 Luytgaerens, 292.
 Lyman, H., 115.
 Lyman, J. F., 623.
 Lynch, C. J., 268.
 Lynn, M. J., 528.
 Lyon, H. L., 346.
 Lyon, T. L., 210, 323.
 McAdie, 418.
 McAdoo, W. G., 388.
 McAlpine, R., & Sons, 398.
 McAtee, W. L., 456, 458.
 McAuliffe, J. P., 618.
 McCaig, J., 289.
 McCall, A. G., 321.
 McCall, J. S. J., 227.
 McCall, M. A., 216.
 McCallum, S. T., 614.
 McCampbell, C. W., 366.
 McCann, G. F., 165, 203, 473.
 McCarrison, R., 565, 570, 869.
 McCarthy, E. F., 900.
 McClelland, T. B., 454.
 McClendon, J. F., 11, 356, 624.
 McClintock, J. A., 538, 553.
 McClure, C. W., 708.
 McClure, H. B., 129, 130, 228.
 McCollam, M. E., 215, 437.
 McCulloch, J. W., 245.
 McCollum, E. V., 161, 255, 471, 472, 473, 869.
 McCombie, W., 766.
 McConnell, H. S., 797.
 McConnell, W. R., 352.
 McCool, M. M., 518.
 McCornack, P. D., 59.
 McCrory, S. H., 98, 381, 460.
 McCrudden, F. H., 804.
 McCubbin, W. A., 650.
 McCue, C. A., 698.
 McCuen, G. W., 100.
 McCullough, E., 486.
 McDaniel, E., 558.
 MacDougall, D. T., 24, 25, 26.
 McDougal, J. B., 592.
 McDougall, E. G., 115.
 MacDougall, R. S., 656.
 McDougall, W. B., 141, 211, 631.
 McFadyean, J., 178, 483.
 McFall, R. J., 387.
 Macfarlane, W., 623, 633.
 McGee, J. M., 25.
 McGinnis, F. W., 830.
 MacGregor, M. E., 660.
 McIlvaine, T. C., 804.
 McInerney, T. J., 175, 295.
 MacInnes, L. T., 771.
 McIntire, W. H., 425.
 McIntyre, J. D., 501.
 McJunkin, F. A., 182.
 McKee, C. M., 775.
 McKerrow, W. A., 396.
 McKillop, A. T., 230.
 McKimmon, J. S., 792.
 Mackintosh, J., 679.
 Macklin, A. H., 360.
 Macklin, T., 192, 289, 594.
 McLaine, L. S., 247.
 McLarty, H. R., 848.
 McLean, F. T., 432.
 MacLean, J. D., 780.
 MacLennan, A. H., 800.
 McLeod, C. C., 834.
 M'Leod, J. W., 80.
 Macmillan, E. J., 597.
 MacMillan, H. G., 145, 241.
 McMillan, T., 493.
 McMiller, P. R., 216.
 McNatt, H. E., 297, 498.
 MacNeal, W. J., 64, 762.
 Macomber, D., 261.
 Macpherson-Grant, G., 766.
 McQuarrie, C. K., 298.
 McRae, W., 448.
 McRostie, G. P., 546.
 Macself, A. J., 173.
 McSwiney, J., 531.
 MacTaggart, A., 120.
 McWhorter, F. P., 398.
 Macy, I. G., 281, 359.
 Madhavan Pillai, R., 656.
 Magnus, H., 203.
 Magoon, C. A., 663.
 Magoon, E. H., 460.
 Maiden, J. H., 137, 737.
 Mains, E. B., 144.
 Maki, K., 669.
 Maki, R., 669.
 Malin, D. F., 532.
 Malloch, J. R., 460.
 Mallock, A., 73.
 Malpeaux, L., 126, 592.
 Malte, M. O., 397, 438.
 Maneval, W. E., 323.
 Maney, T. J., 539, 736.
 Mangenot, G., 824.
 Mangin, L., 128.
 Mangin, M., 92.
 Manio, R. V., 808.
 Mankiewicz, F., 437.
 Mann, A. R., 898.
 Mann, W. M., 159.
 Manninger, R., 279.
 Manns, T. F., 239, 543, 547, 551, 645.
 Manrin, G., 890.
 Mansfield, W. S., 216.
 Mantz, J., 796.
 Manuel, H. L., 849.
 Marbut, C. F., 620.
 Marchal, P., 560.
 Marchand, B. de C., 712.
 Marcovitch, S., 153.
 Marek, T., 684.
 Marengli, E., 70.
 Margosches, B. M., 709.
 Mark, K. L., 258.
 Markley, A. L., 207.
 Marks, J. R., 886.
 Marlatt, A., 697.
 Marlatt, C. L., 152.
 Marquardt, J. C., 578.
 Marrs, J. W., 596.
 Marsh, A. R., 658.
 Marsh, C. D., 82, 280.
 Marsh, C. E., 174.
 Marshall, F. R., 170.
 Marshall, G. A. K., 461.
 Marshall, R. E., 243.
 Marshall, W. D., 312.
 Martel, H., 479.
 Martin, C. C., 383.
 Martin, F. J., 34.
 Martin, J. H., 385, 770, 876.
 Martin, J. N., 95, 433.
 Martin, O. B., 296, 393.
 Martin, T. L., 212.
 Martin, W. H. (N. J.), 526, 548, 549, 649.
 Martin, W. H. (Pa.), 700.
 Marvel, C. S., 414.
 Marzocchi, 882.
 Mascart, J., 16.
 Mason, A. F., 156.
 Mason, F. A., 52.
 Mason, H. C., 783.
 Masoni, G., 320.
 Massey, G. B., 381.
 Massey, R. E., 34.
 Masslich, C. B., 86.
 Mat, F., 94.
 Matheu, C. P., 760.
 Mathews, G. M., 49.
 Matsumoto, Takashi, 325.
 Matsumoto, Torata, 888.
 Matsura, S., 900.
 Matthew, J. G., 591.

- Matthews, (Mrs.) D. J., 544.
 Mattick, A. T. R., 75, 76, 176.
 Mattill, H. A., 62, 566.
 Mattimore, H. S., 780.
 Mattoon, W. R., 237.
 Matz, J., 148, 242, 450, 545, 550.
 Maulik, S., 461.
 Mavor, J. W., 678.
 Mayer, L. S., 797.
 Maynard, L. A., 870.
 Mayne, B., 152, 460.
 Mayo, R. V., 823.
 Mayr, C., 729.
 Mead, E., 98, 599.
 Mead, S. W., 879.
 Meade, C. W., 466.
 Meade, G. P., 113, 507.
 Meadows, W. R., 133, 635, 729.
 Means, J. H., 260.
 Mears, B., 615.
 Meckstroth, J. T., 718.
 Medalia, L. S., 110.
 Medalla, M. G., 46, 347.
 Medes, G., 761.
 Meerland, L., 49.
 Mees, C. E. K., 111.
 Meharry, C. L., 784.
 Meigs, E. B., 871, 878.
 Meigs, J. V., 87.
 Meijer, C., 718.
 Meinzer, O. E., 381.
 Meisinger, C. L., 115.
 Melander, A. L., 58.
 Meline, J., 898.
 Mell, C. D., 737.
 Mellanby, M., 562.
 Melle, H. A., 232.
 Mellon, R. R., 413.
 Meloy, G. S., 229, 833.
 Menaul, P., 630.
 Mendel, L. B., 255, 566, 603, 605, 758, 760.
 Mendes, C. T., 810.
 Mendiola, N. B., 730.
 Mendum, S. W., 389.
 Mentz, H., 487.
 Mercer, J. H., 178.
 Mercier, W. B., 297.
 Merejkovsky, C. de, 722.
 Merres, E., 12.
 Merriam, C. H., 656.
 Merrill, M. C., 299.
 Merrill, R. M., 197.
 Merritt, E., 597.
 Merz, R. G., 12.
 Metcalf, C. L., 396.
 Metcalf, L., 891.
 Metcalf, W., 644.
 Metcalf, Z. P., 747.
 Meunissier, A., 125.
 Meurer, R., 75.
 Meurice, R., 14.
 Meyer, A. H., 422.
 Meyer, D., 131.
 Meyer, F. J., 224.
 Meyer, F. N., 538.
 Meyer, K. F., 262, 776.
 Meysenbug, L. von, 203.
 Mezger, C., 422.
 Mezzadrol, J., 509.
 Michel, C. W., 243.
 Michel, P., 761.
 Mickel, C. E., 699.
 Middlebrook, W., 281.
 Middleton, W., 464, 661.
 Middleton, W. A., 139.
 Miège, E., 647.
 Milam, A. B., 796.
 Mildner, 753.
 Miles, H. W., 153, 457.
 Millard, W. A., 37, 450.
 Miller, C. E., 389.
 Miller, D., 460.
 Miller, E., 792.
 Miller, E. J., 21.
 Miller, E. S., 860.
 Miller, E. W., 759.
 Miller, F. H., 542.
 Miller, H. G., 123.
 Miller, H. H., 895.
 Miller, M. F., 315, 511, 791.
 Miller, P. L., 290.
 Miller, R. B., 141.
 Miller, R. C., 766.
 Milligan, S., 544, 722, 742.
 Milliken, F. B., 158.
 Milne, D., 634.
 Milner, R. D., 254.
 Milward, R. C., 238.
 Miñano, G. M., 785.
 Mitchell, C. A., 111.
 Mitchell, C. L., 618.
 Mitchell, H. H., 365.
 Mitchell, H. S., 758.
 Mitchell, J. S., 641.
 Mitchell, J. W., 680.
 Mitchener, A. V., 458.
 Mitscherlich, E. A., 318.
 Miura, M., 11, 806.
 Mjöberg, E., 53.
 Mojonner, T., 710.
 Möller-Holst, E., 37.
 Molliard, M., 723.
 Molz, E., 51, 545.
 Monier-Williams, G. W., 110.
 Monteith, H. R., 699.
 Montes, Z., 109.
 Montgomery, C. W., 394.
 Montgomery, E. G., 437.
 Montgomery, R. E., 778.
 Montreuil, J. E., 836.
 Moody, C. S., 287.
 Mooers, C. A., 8, 133, 425, 829.
 Moon, T. J., 696.
 Moore, B., 824, 825.
 Moore, C. R., 265.
 Moore, F. J., 174.
 Moore, J., 479.
 Moore, J. M., 381.
 Moore, M. G., 899.
 Moore, S. G., 879.
 Moore, W., 852.
 Moorhouse, L. A., 195, 493.
 Moreira, C., 57.
 Moreland, C. C., 849.
 Morgan, A. E., 98.
 Morgan, G. W., 328.
 Morgan, H. J., 866.
 Morgen, A., 74.
 Morgulis, S., 10.
 Moriarty, M. E., 756.
 Mörig, E., 279.
 Moritz, E. A., 84.
 Mormon, J. B., 192.
 Morrell, J. C., 111.
 Morrill, A. W., 852.
 Morris, C. C., 808.
 Morris, O. M., 817.
 Morris, R. T., 40.
 Morrison, A. C., 785.
 Morrison, H., 351.
 Morrison, H. A., 614.
 Morry, A., 386.
 Morse, S., 681.
 Morse, W. J., 123.
 Morstatt, H., 53.
 Mosier, J. G., 315, 712.
 Mosséri, V. M., 518.
 Moton, R. R., 89.
 Mottet, S., 744.
 Mottram, J. C., 62, 867.
 Moulton, C. R., 66.
 Mounce, M. J., 771.
 Mouriquand, G., 761.
 Mozzette, G. F., 351, 458, 659, 748, 752.
 Mudge, C. S., 76, 274.
 Muhlfield, M., 862.
 Mulford, F. L., 41, 843.
 Müller, C., 616.
 Müller, H. C., 51, 545.
 Mullis, I. B., 186, 187.
 Mumford, F. B., 168, 362, 394, 495.
 Mumford, H. W., 699, 794.
 Munch, J. C., 468.
 Munn, M. T., 732.
 Munns, E. N., 446.
 Münter, F., 131.
 Murata, M., 668.
 Murdock, H. E., 98.
 Murdock, V., 290.
 Murlin, J. R., 257, 755.
 Murneek, A. E., 641.
 Murphy, L., 73.
 Murphy, P. A., 145, 242, 847.
 Murray, J. A., 672.
 Murray, M. F., 203.
 Murray, T. J., 423.
 Musgrave, G. R., 530.
 Mussehl, F. E., 171.
 Musselman, H. H., 99.
 Muto, K., 900.
 Muttelet, C. F., 14, 311.

- Muttkowski, R. A., 456.
 Myers, B. A., 506.
 Myers, C. E., 839.
 Myers, P. R., 464.
 Myers, V. C., 805.
 Myers, W. I., 287, 783.
 Myrbäck, K., 866.

 Nace, F. A., 499.
 Nagayo, M., 560.
 Nakamura, S., 494.
 Nanji, D. R., 112.
 Narasimhan, M. J., 343.
 Nater, 390.
 Nathansohn, A., 432.
 Naumann, W. R., 97.
 Needs, F. E., 204.
 Neff, C. E., 331.
 Neger, 450.
 Nègre, L., 376, 581.
 Neill, J., 412.
 Neller, J. R., 123, 199, 526.
 Nelson, D. H., 372.
 Nelson, E. K., 311.
 Nelson, E. M., 469.
 Nelson, H. A., 586.
 Nelson, J. W., 17.
 Nelson, P., 711.
 Nelson, R. A., 381.
 Nelson, T. C., 576.
 Nelson, W. R., 872.
 Netolitzky, F., 51.
 Neubauer, H., 71.
 Neumann, B., 819.
 Nevens, W. B., 504, 505.
 Neville, H. A. D., 131.
 Newcomer, E. J., 657.
 Newcomer, H. S., 201.
 Newell, F. H., 687.
 Newell, W., 850.
 Newland, D. H., 218.
 Newlon, W. E., 598.
 Newman, H. G., 377, 378, 379.
 Newnham, W. L., 220.
 Newsham, J. C., 696.
 Newton, J. H., 55.
 Newton, R., 790, 871.
 Newton, W., 19.
 Nicholls, H. M., 848, 501.
 Nichols, R. W., 162.
 Nicholson, A. J., 459.
 Nicholson, F. A., 664.
 Nickels, C. B., 797.
 Nicolas, E., 682.
 Niekerk, M. van, 227.
 Nieschulz, I. O., 886.
 Nightingale, G. T., 138.
 Niles, R. W., 194.
 Nirenstein, E., 568.
 Niswonger, H. R., 395.
 Nitta, N., 900.
 Nitzescu, J. J., 167.
 Nixon, W. H., 856.
 Nobbe, F., 37.
 Nobel, E., 360.

 Noble, W. C., 275.
 Nocard, 579.
 Nolan, T., 691.
 Nolte, O., 425, 818.
 Normandin, A., 84.
 Norris, A. D., 498.
 Norris, G. W., 137.
 North, D. S., 347.
 Nougaret, R. L., 40, 642.
 Nourse, E. G., 90, 595, 783.
 Novák, W., 421.
 Novaro, P., 359.
 Nowacki, A., 511.
 Nowell, W., 454.
 Nuckols, S. B., 331.
 Nuñez Tovar, M., 852.
 Nussey, G. F., 227.
 Nussbag, W., 774.
 Nyberg, C., 287.
 Nydegger, O., 820.
 Nye, L. L., 259.
 Nye, P. B., 779.

 Oakley, R. A., 531, 834.
 Ober, G., Jr., 522.
 Oberholser, H. C., 456, 851.
 O'Brien, C., 91.
 O'Brien, D. G., 677.
 O'Brien, F. P., 897.
 Obuljen, M., 495.
 Odén, S., 621, 814.
 Odermatt, E., 375.
 Oertel, H. W., 94.
 Offringa, D. D., 878.
 Ogata, C., 668.
 Ogden, H. N., 782.
 Ohlmer, E., 74.
 Oka, C., 668.
 O'Kane, W. C., 457.
 O'Kelly, J. F., 396, 729.
 Older, C., 86, 889.
 O'Leary, W. J., 86.
 Olney, A. J., 135.
 Olney, R., 100.
 Olson, C., 432.
 Olson, G. A., 427.
 Olson, O., 837.
 O'Meara, P., 168.
 O'Neal, A. M., Jr., 17.
 Ong, E. R. de, 159, 160, 537, 853.
 Onodera, I., 715.
 Onslow, H., 112.
 Oosthuizen, J. P., 832.
 Orcutt, M. L., 882.
 Orr, J. B., 681.
 Orr, P. F., 467.
 Orton, C. R., 344.
 Orton, W. A., 570.
 Orwin, C. S., 493.
 Osborn, T. G. B., 44.
 Osborne, T. B., 9, 255, 499, 566, 603, 605, 758, 801.
 Osenbrug, A., 327.
 Oses, R. G., 31.
 Oskamp, J., 139.

 Osmaston, B. B., 238, 541.
 Osmun, A. V., 43.
 Ossat, G. de A. d', 627.
 Osterberg, E., 417.
 Osterhout, W. J. V., 128.
 Ostrander, J. E., 209, 419, 809.
 Ostrander, W. A., 36.
 Osugi, S., 621.
 Otto, R., 220.
 Ottow, B., 266.
 Over, W. H., 245.
 Owen, I. L., 574.
 Oxholm, A. H., 237.
 Ozorio de Almeida, A., 671.

 Pachano, A., 449.
 Packard, 253.
 Page, T. W., 495.
 Pagé, V. W., 890.
 Paguirigan, D. B., 232.
 Paige, J. B., 81.
 Paillot, A., 851.
 Paine, H. S., 508.
 Paine, S. G., 44, 447.
 Palladin, V. I., 799.
 Palm, B. T., 551.
 Palmer, C. C., 882.
 Palmer, L. S., 802.
 Palmer, S., 667.
 Palmer, T. W., 874.
 Pammel, L. H., 222, 449, 545.
 Panisset, L., 182, 482.
 Papageorgiou, P., 535.
 Pape, J., 277, 774.
 Pappenheimer, A. M., 165, 203, 473.
 Parham, H. C., 651.
 Paris, J. M., 490.
 Park, E. A., 471, 472, 473, 869.
 Park, W. H., 75.
 Parker, F. W., 420, 810.
 Parker, G., 460.
 Parker, J. H., 144.
 Parker, J. R., 156, 352, 855.
 Parker, R. R., 59, 555.
 Parker, S. L., 661.
 Parker, T., 641, 662.
 Parker, W. H., 129.
 Parks, H. B., 160.
 Parks, K. E., 288.
 Parks, T. H., 246, 749.
 Parr, A. E., 227.
 Parr, S. W., 626.
 Parrott, F. W., 779.
 Parrott, P. J., 51.
 Parry, E. J., 308.
 Parsons, H. T., 161.
 Passelègue, G., 886.
 Patel, P. G., 777, 881.
 Paterson, W. G. R., 873.
 Paton, D. N., 360, 669, 681.
 Patten, A. J., 168, 444.
 Patterson, A. J., 94.

- Patterson, S. H., 592.
 Patterson, T. H., 221.
 Patton, C. A., 510.
 Patton, W. S., 59.
 Patty, R. L., 99.
 Paul, E., 502.
 Paulig, H., 318.
 Pavé, S., 279.
 Pearl, R., 661, 672.
 Pearson, K., 410.
 Pearson, R. A., 301.
 Pearson, T. G., 4556.
 Peck, F. W., 291.
 Peck, M. E., 222.
 Peden, F. T., 269.
 Peglion, V., 92.
 Peirson, H. B., 253.
 Peluffo, A. T., 351.
 Penau, H., 569.
 Penny, D. D., 56, 855.
 Pennypacker, J. Y., 27, 826.
 Penquite, R., 395.
 Pepoon, H. S., 141.
 Percival, J., 124, 837.
 Percy-Lancaster, S., 41.
 Pereira, H., 236.
 Peren, G. S., 460.
 Perkins, A. J., 20, 138, 219, 696, 891.
 Perrée, W. F., 791.
 Perret, C., 44.
 Perrot, E., 469.
 Perry, W. J., 644.
 Pershad, B. R., 125.
 Person, E., 699.
 Pestana, B. R., 579.
 Peter, A., 276.
 Peters, J. G., 645.
 Peters, W. H., 396.
 Petersen, Korff, 891.
 Petersen, K. D., 36, 37.
 Petersen, W. F., 280.
 Peterson, A., 156, 556, 557, 861.
 Peterson, A. C., 612.
 Peterson, W. H., 208, 502, 503.
 Petherbridge, F. R., 241, 460.
 Pethybridge, G. H., 743.
 Petit, A., 338, 540, 839.
 Petroff, S. A., 775.
 Pettersson, A., 866.
 Pettigrove, H. R., 699.
 Pettit, R. H., 457.
 Peyronel, B., 241, 850, 851.
 Pfanstiehl, C., 113.
 Pfeiffer, T., 627.
 Pfotenhauer, C., 627.
 Phillips, A. G., 574, 875.
 Phillips, E. F., 752, 858.
 Phillips, M., 203.
 Phillips, W. J., 155.
 Phipps, C. R., 299, 499.
 Picard, F., 253.
 Pichard, G., 841.
 Pickels, G. W., 381.
 Pickett, B. S., 444.
 Pickholz, E., 798.
 Pieper, H., 134.
 Pillai, N. K., 634.
 Pillai, R. M., 656.
 Ping, C., 751.
 Pinkney, R. M., 699.
 Pinner, L., 798.
 Piot, J.-B., 580.
 Pipal, F. J., 546.
 Piper, C. V., 721.
 Pittman, M. S., 392, 791.
 Plá, M. G., 796.
 Plaisance, G. P., 804.
 Plagge, H. H., 241.
 Plank, H. K., 54.
 Platt, E. E., 247.
 Pimmer, R. H. A., 161, 255.
 Plummer, J. K., 24.
 Poeteren, N. van, 448, 451.
 Pohr, E., 694.
 Polak, M. W., 585.
 Polonowski, M., 12, 709.
 Pool, W. A., 481.
 Poole, A. K., 79.
 Poole, R. F., 547, 548.
 Poos, F. W., 155.
 Pope, M. N., 329.
 Popenoe, W., 842.
 Popoff, M., 51.
 Porcher, C., 205.
 Porter, R. H., 650.
 Portheim, L., 449.
 Potter, E. L., 169, 170.
 Potter, G. F., 641.
 Potter, L. M., 257.
 Potts, C. G., 170.
 Potts, R. C., 177.
 Potvliet, M., 616.
 Pouleff, S., 853.
 Pound, G. H., 273.
 Poutiers, R., 248, 852.
 Povitzky, O. R., 80.
 Powell, G. H., 199, 599.
 Power, F. B., 202, 207.
 Powers, 418.
 Powers, G. F., 869.
 Prain, D., 300, 400.
 Pratt, J. H., 381.
 Prax, J., 710.
 Prayag, S. H., 842.
 Preiss, F., 518, 620, 621, 638.
 Prell, H., 51.
 Prescott, J. A., 439, 518.
 Prey, L. du, 497.
 Price, O. B., 315.
 Price, W. H., 174, 177.
 Pridham, J. T., 442, 531.
 Priestley, J. H., 431, 631.
 Priestman, H., 72.
 Priewe, W., 881.
 Prince, A. L., 428.
 Principi, P., 215.
 Pringsheim, H., 68.
 Pritchett, L. B., 259.
 Pritzker, J., 416.
 Pröscholdt, 775.
 Prucha, M. J., 175, 373, 772.
 Prunet, A., 48.
 Punnett, R. C., 272.
 Puntoni, V., 278.
 Puschkaroff, N., 423.
 Putnam, G. A., 194, 696.
 Putterill, V. A., 653.
 Quaintance, A. L., 156, 235.
 Quanjer, H. M., 636.
 Quayle, E. T., 418.
 Quayle, H. J., 855.
 Quesenberry, G. R., 135, 169, 173.
 Quiroga, R., 485.
 Quisumbing, F. A., 113.
 Quittner, M. R., 807.
 Rabak, F., 613.
 Raber, O. L., 126.
 Raciborski, 829.
 Rackemann, F. M., 374.
 Rader, F. E., 97.
 Radspinner, W. A., 539.
 Ragsdale, A. C., 371, 372, 771.
 Rahn, O., 75, 818.
 Raines, W. G., jr., 508.
 Raisch, E., 86.
 Rakestraw, N. W., 475.
 Ramann, E., 821.
 Ramirez, R., 451.
 Ramsay, A. A., 859.
 Ramsay, J. M., 496.
 Ramsbottom, J. K., 553.
 Rands, R. D., 349.
 Rangaswami Ayyangar, G. N., 134.
 Rankin, W. H., 899.
 Ransom, B. H., 151, 685, 885.
 Rao, D. A., 276.
 Rao, P. S. J., 245.
 Rapeer, L. W., 294.
 Rapp, C. W., 537.
 Rau, H. B., 645.
 Raum, 437.
 Ravaz, L., 48, 745.
 Ravenna, C., 324.
 Ravenna, E., 481, 579.
 Raw, N., 280.
 Rawes, A. N., 39, 840.
 Rea, G. H., 396.
 Rea, M. W., 523, 527.
 Read, J. W., 108, 667, 709, 715.
 Record, S. J., 143, 445, 446, 737, 843.
 Records, E., 634.
 Reddick, D., 848.
 Reddish, G. F., 177, 262.
 Redfield, H. W., 177.
 Redway, J. W., 711.

- Reed, C. A., 41.
 Reed, H. S., 127.
 Reeder, J. C., 805.
 Reedy, J. H., 613.
 Reek, R. W., 398.
 Reese, H. H., 369.
 Regan, J. C., 375.
 Régnier, R., 852.
 Reh, L., 51, 458, 459.
 Rehous, L., 322.
 Rehfuss, M. E., 666.
 Reichert, F., 814.
 Reichert, N., 798.
 Reid, F. R., 716.
 Reid, W. H. E., 372.
 Reif, G., 505.
 Reiher, H., 86.
 Reinhard, H. J., 750.
 Reinking, O. A., 45, 46, 347,
 554, 741, 746, 845.
 Reisner, J. S., 141.
 Remington, J. S., 502.
 Remy, P., 465.
 Rendle, A. B., 222.
 Rennie, J., 464, 857, 858.
 Ressler, I. L., 549, 660.
 Rettger, L. F., 584, 870.
 Retuerta, M. G., 136.
 Rew, H., 496.
 Rew, R. H., 391, 495.
 Reyes, L. J., 445.
 Reynolds, E., 261.
 Reynolds, L., 708.
 Reynolds, M. H., 482.
 Reynolds, R. V., 739.
 Reynoldson, L. A., 383.
 Rhoades, E. L., 389.
 Rhoads, A. S., 499, 851.
 Ricci, U., 596, 730.
 Rice, F. E., 207.
 Richards, B. L., 147.
 Richards, E. H., 217.
 Richards, I., 879.
 Richardson, C. W., 125.
 Richardson, W. D., 256.
 Richmond, H. D., 113, 274.
 Richter-Quittner, M., 807.
 Riddell, F. T., 493, 577.
 Riddle, O., 267, 769.
 Rideal, E. K., 310.
 Rideal, S., 310.
 Ridgell, R. H., 322, 395, 709.
 Ridley, G. B., 12.
 Riehm, 449.
 Ries, H., 487.
 Rieu, J. L., 480.
 Rieux, J., 482.
 Rigold, B. F., 238.
 Riker, R., 783.
 Riley, C. V., 157.
 Riley, P. B., 480.
 Riley, W. A., 84, 686, 886.
 Rindl, M., 109.
 Ring, E. R., 795.
 Ringelmann, M., 886, 889.
 Rinjard, P., 682.
 Rippel, A., 69, 627.
 Rivera, A., 796.
 Rivers, T. M., 79.
 Rivière, G., 140, 337, 841.
 Rixford, G. P., 444.
 Roadhouse, C. L., 174.
 Roadhouse, W. B., 696.
 Robbins, W. J., 16, 323.
 Robert, D., 199.
 Roberts, A. W. R., 462.
 Roberts, E., 368.
 Roberts, G., 33.
 Roberts, G. A., 683.
 Roberts, J. W., 148, 348.
 Robertson, E., 273.
 Robertson, G. S., 521.
 Robinson, C. P., 586.
 Robinson, C. S., 21.
 Robinson, J. H., 875.
 Robinson, T. R., 40, 339.
 Robison, R., 261.
 Robison, W. L., 368.
 Robotka, F., 290, 595.
 Robson, J. T., 490.
 Rodríguez, S. S., 392.
 Roehrich, O., 230, 635.
 Rogers, E. C., 142.
 Rogers, L. A., 97, 772, 803.
 Rohwer, S. A., 58, 160, 661.
 Rolf, I. P., 11.
 Rolfs, P. H., 95.
 Römer, K., 280.
 Root, G. A., 654.
 Rosa, J. T., Jr., 332, 443, 827.
 Rose, R. E., 430.
 Rose, W. C., 757.
 Rosen, H. R., 724.
 Rosenau, M. J., 571, 859.
 Rosenbaum, J., 148.
 Rosenfeld, A. H., 34.
 Rosenthal, L. V., 571.
 Ross, G. E., 486.
 Ross, H. A., 577, 679.
 Ross, N. M., 234, 843.
 Ross, S. G., 63.
 Rossell i Vilá, M., 875.
 Rossi, G., 513.
 Rost, C. O., 216.
 Roster, G., 813.
 Rostrup, S., 153.
 Rothgeb, B. E., 636.
 Rouaud, 573.
 Rousseaux, E., 294.
 Rousseu, Brocq., 885.
 Roussilhe, H., 84.
 Routt, G. C., 836.
 Roux, E., 579.
 Rowell, L. W., 522.
 Rowntree, L. G., 861.
 Roxas, M. L., 808.
 Roy, C. B., 359.
 Roy, J.-A., 383.
 Roy, S. C., 33.
 Royall, R. E., 285.
 Rubinstein, M., 276.
 Rudolfs, W., 732.
 Rue, W. F., 195.
 Ruehle, G. L. A., 413.
 Ruhman, M. H., 154.
 Ruhmann, M. H., 352.
 Ruiz Valencia, G., 33.
 Rumsey, W. E., 242, 243.
 Runkel, H., 468.
 Rupp, G. F., 198.
 Rupp, P., 274.
 Russell, A. M., 846.
 Russell, E., 204.
 Russell, E. J., 23, 88, 216,
 623, 809.
 Russell, G. A., 208.
 Russell, H. L., 97, 221.
 Ruston, A. G., 784.
 Ruth, W. A., 855.
 Ruzicka, C. H., 700.
 Ryan, M., 179.
 Ryder, E. H., 89.
 Sabin, A. H., 688.
 Sablon, M. L. du, 126.
 Sacqhem, R. Van, 376, 683,
 881, 883.
 Sachweh, 278.
 Sackett, C. C., 299.
 Sadler, W., 771.
 Safford, W. E., 430.
 Sage, W. H., 399.
 Sagnier, H., 637, 898.
 St. John, C., 555.
 St. John, J. H., 682.
 St. John, J. L., 199, 427.
 Ste. Marie, J. A., 893.
 Salaman, R. N., 126, 730.
 Sales, E. K., 559.
 Salisbury, E. J., 142.
 Salkowski, E., 68.
 Salmon, E. S., 742.
 Salmon, S. C., 136, 829.
 Salmon, W. D., 168, 797.
 Salter, R. M., 621.
 Salthe, O., 175.
 Sammis, J. L., 879.
 Sampson, K., 239, 240.
 Sanders, G. E., 51, 397, 455,
 845.
 Sanders, T. W., 656.
 Sanderson, D., 89, 596, 895.
 Sando, C. E., 125, 308.
 Sandstedt, R., 700.
 Sandstedt, R. M., 171.
 Sandwall, A. W., 259.
 Santisteban, J. S., 638.
 Santos, C. F. O., 667.
 Sanyal, P. B., 730.
 Sargent, C. S., 737.
 Sarraut, A., 651.
 Sasscer, E. R., 748.
 Satherthwait, A. F., 560.
 Saunders, A. M. C., 766.
 Saunders, C. E., 36, 162, 397.
 Saunders, E. R., 223.
 Savage, E. S., 273.
 Savage, W. G., 753.

- Sawamura, S., 53.
 Sawyer, E. J., 456.
 Sayles, M., 792.
 Sax, K., 430, 841.
 Sbrozzi, D., 291.
 Scasso, J. M., 269.
 Schaefer, O. G., 198.
 Schaus, W., 157.
 Schelbe, M., 437.
 Schein, H., 181.
 Schereschewsky, P., 711.
 Scherffius, W. H., 227.
 Schermerhorn, L. G., 536.
 Schern, K., 82.
 Schieferstein, W., 510.
 Schilling, C., 671.
 Schilling, H. von, 458.
 Schindler, G., 735.
 Schindler, H., 531.
 Schlecht, F., 832.
 Schlesinger, M. J., 361, 669, 670.
 Schlick, W. J., 283.
 Schlumberger, O., 231, 232.
 Schmaltz, R., 178.
 Schmidt, E. W., 292.
 Schmidt, L., 470.
 Schmidt, M. B., 756.
 Schmit-Jensen, H. O., 69.
 Schmitz, H., 150.
 Schmoll, H. M., 141.
 Schneck, H. W., 839.
 Schneider, E. C., 794.
 Schneider, F. L., 684.
 Schneider, G., 533.
 Schneiderhan, F. J., 397.
 Schneiderwirth, I., 755.
 Schneidewind, W., 131, 821.
 Schoenmann, L. R., 18.
 Schoevers, T. A. C., 451, 741.
 Scholer, C. H., 284.
 Schöler, G., 74.
 Schopmeyer, C. H., 898.
 Schoppe, W. F., 273, 693.
 Schribaux, 232, 835.
 Schroeder, E. C., 683.
 Schryver, S. B., 802.
 Schuchert, C., 524.
 Schulte, J. I., 598.
 Schulte-Herkendorf, 881.
 Schultz, E. S., 148.
 Schültze, W., 753.
 Schuster, C. E., 340.
 Schuster, G. L., 624.
 Schütz, 485.
 Schwalbe, C. G., 572.
 Schwartz, B., 379.
 Schwartz, M., 447.
 Schwartz, E. W., 654, 655.
 Schwarz, E., 204.
 Schwarz, E. A., 857.
 Schwarze, H., 181.
 Scipio, L. A., 691, 692.
 Scoates, D., 99.
 Scott, A. L., 730.
 Scott, H. (England), 857.
 Scott, H. (Kans.), 622.
 Scott, R. D., 807.
 Seaman, L. N., 888.
 Seamans, A. E., 724, 767, 830.
 Seamans, H. L., 352.
 See, P., 455.
 Seeley, D. A., 419.
 Seelhorst, C. von, 517.
 Seidell, A., 864.
 Selby, H. E., 695.
 Sell, M. T., 61, 257.
 Selligren, G., 532.
 Semmler, F. W., 68.
 Sen, S. K., 856.
 Serrano, F. E., 745.
 Severin, H. C., 50, 58, 750.
 Severin, H. H. P., 396, 658, 854.
 Seymour-Jones, A., 661, 682.
 Shaffer, S., 115, 116.
 Shamel, A. D., 642.
 Shannon, W. R., 564.
 Shapovalov, M., 146.
 Sharma, L. C., 227.
 Sharp, L. W., 823.
 Sharp, P. F., 795.
 Sharwood, J. A., 755.
 Shattuck, C. H., 312, 341.
 Shaw, E. B., 776.
 Shaw, J. A., 805.
 Shaw, J. K., 196.
 Shaw, R. H., 205.
 Shaw, R. S., 498, 598.
 Shaw, W. T., 555.
 Shay, W. W., 491.
 Shear, C. L., 235.
 Shedd, O. M., 310.
 Sheehy, E. J., 878.
 Sheets, E. W., 675, 765.
 Shepard, C. W., 91.
 Shepard, W., 341.
 Shepherd, J. B., 771.
 Shepperd, J. H., 367, 878.
 Sherman, H. C., 165, 355, 469, 562, 667, 707, 708, 862, 863, 865.
 Sherrard, G. C., 231.
 Shertzer, T. B., 688.
 Sherwood, S. F., 207.
 Sherwood, S. R., 766.
 Shevsky, M. C., 506.
 Shipley, A., 399, 461.
 Shipley, P. G., 471, 472, 473, 869.
 Shippen, L. P., 178.
 Shive, J. W., 525, 526, 629.
 Shizume, S., 669.
 Shoaff, P. S., 23.
 Shohl, A. T., 201.
 Shollenberger, J. H., 665.
 Shorten, J. A., 359.
 Shotwell, J. T., 593.
 Shoup, G. R., 297, 478.
 Shoup, (Mrs) G. R., 478.
 Shreve, E. B., 26.
 Shreve, F., 26.
 Shreve, R. N., 719.
 Shuler, M., 294.
 Shunk, I. V., 740.
 Shutt, F. T., 167, 269, 512.
 Siegler, E. H., 54.
 Sleglinger, J. B., 230.
 Sievers, A. F., 501.
 Siler, J. F., 762.
 Silió, 392.
 Silvestri, F., 53, 559.
 Simmonds, N., 161, 471, 472, 473, 869.
 Simmons, W. H., 183.
 Simon, E., 555.
 Simonnet, H., 569, 570.
 Simons, G. W., jr., 460.
 Simpson, J. H., 729.
 Simpson, S., 634.
 Simpson, S. G., 805.
 Sinclair, J. M., 880.
 Singh, K., 778.
 Sinnott, E. W., 27, 825, 826.
 Siperstein, D. M., 265.
 Sisson, W. R., 174.
 Sitenský, F., 497.
 Sjöström, A., 530.
 Skaife, S. H., 247.
 Skerrett, R. G., 590.
 Skinner, J. F., 782.
 Skinner, J. H., 476, 477.
 Skinner, J. J., 716.
 Skinner, W. W., 113, 754.
 Skrjabin, K. J., 83.
 Sladen, F. W. L., 254.
 Slagg, C. M., 333.
 Slagle, E. A., 413.
 Slate, G. L., 700.
 Slate, W. L., jr., 298, 835.
 Slocum, R. R., 172, 272, 769.
 Small, J., 527, 528.
 Small, W., 149.
 Smart, T. J., 897.
 Smies, E. H., 17, 815.
 Smit, B. J., 713.
 Smith, A., 479.
 Smith, C. A., 667, 759.
 Smith, E., 761.
 Smith, E. B., 489.
 Smith, G. E., 770.
 Smith, G. P. D., 453, 745, 846.
 Smith, H. A., 209, 389.
 Smith, H. C., 898.
 Smith, H. S., 53, 749.
 Smith, K., 268.
 Smith, L., 33.
 Smith, L. B., 45, 336, 538.
 Smith, L. J., 99.
 Smith, M. H., 299.
 Smith, P. R., 700.
 Smith, P. W. B., 475, 869.
 Smith, R. C., 458, 660.
 Smith, R. E., 350.
 Smith, R. H., 855.
 Smith, R. S., 174, 175.

- Smith, S. L., 863.
 Smith, T. O., 674.
 Smith-Gordon, L., 91.
 Smyth, E. G., 250.
 Smyth, H. F., 480.
 Smythies, E. A., 238.
 Snedden, D., 193, 296, 597.
 Snell, F. D., 709.
 Snell, J., 146.
 Snell, K., 231.
 Snell, W. H., 150.
 Snodgrass, R. E., 853.
 Snowden, J. D., 844.
 Snyder, M. F., 695.
 Snyder, T. E., 750.
 Sokolowa, O., 718.
 Somers, R. E., 487.
 Sommer, H. H., 681.
 Souba, A. J., 97.
 South, F. W., 455.
 Souza, W. W. C. de, 229.
 Spaeth, C. P., 674.
 Spafford, W. J., 35.
 Speare, A. T., 245.
 Spears, H. D., 572.
 Speck, P. A., 191.
 Spencer, G. L., 15.
 Spencer, S., 768.
 Spencer, W. H., 666.
 Sperry, D. R., 614.
 Spierenburg, D., 741.
 Spinks, G. T., 39.
 Spitzer, G., 205.
 Spoehr, H. A., 25, 26.
 Spohr, W. H., 296.
 Spooner, C. S., 457.
 Spragg, F. A., 132, 535.
 Sprague, T. O., 299.
 Spray, R. S., 582.
 Spring, S. N., 42.
 Springer, J. F., 614.
 Stacey, A. E., Jr., 12.
 Stackhouse, H. M., 124.
 Stadler, L. J., 34, 326, 834.
 Stafseth, H. J., 584.
 Stahl, J. L., 233, 498.
 Stainton, F. H., 778.
 Stallings, J. H., 518.
 Stammers, A. D., 256.
 Stang, A. H., 490.
 Stanley, L., 257.
 Stanton, T. R., 134.
 Stapledon, R. G., 129, 240, 727.
 Staples, M. H., 493.
 Starky, E. B., 810.
 Starring, C. C., 327.
 Staub, A., 774.
 Stearns, G., 757.
 Stearns, L. A., 659, 750.
 Steece, H. M., 532.
 Steele, E. T., 276.
 Steenbock, H., 61, 65, 257, 469, 566.
 Steer, L., 667.
 Steffen, M., 276.
 Stein, E., 834.
 Steinach, 266.
 Stent, S. M., 232.
 Step, E., 656.
 Stephenson, R. E., 118, 211.
 Stevens, F. L., 431.
 Stevens, O. A., 732.
 Stevenson, A. F., 177, 179.
 Stevenson, H. C., 164.
 Stevenson, J. A. (Pittsburg, Pa.), 193.
 Stevenson, J. A. (U. S. D. A.), 149.
 Stevenson, L., 140.
 Stevenson, L. S., 235.
 Stevenson, W., 679.
 Stevenson, W. H., 394.
 Stewart, C. L., 893.
 Stewart, C. R., 807.
 Stewart, F. C., 447, 451.
 Stewart, G., 388, 829.
 Stewart, J. P., 400.
 Stewart, R., 626.
 Stift, A., 744.
 Stiles, G. W., Jr., 883.
 Stillinger, C. R., 849.
 Stirling, F., 48.
 Stockman, S., 773.
 Stocks, H. B., 518.
 Stockwell, C. W., 751.
 Stokes, W. B., 746.
 Stokoe, W. N., 109.
 Stone, H., 779.
 Stone, R. W., 219.
 Stone, W. C., 138.
 Stonham, J., 895.
 Stoquer, J., 622.
 Storm van Leeuwen, W., 470.
 Story, C., 661.
 Strahan, J. L., 99, 491.
 Strand, A. L., 352.
 Strauch, T. J., 175.
 Strausbaugh, P. D., 141.
 Streeter, L. R., 700.
 Strell, M., 88.
 Strickenberg, L. R., 490.
 Strickland, E. H., 247, 397.
 Strickland, L. F., 351.
 Striegel, 13.
 Strohecker, R., 753.
 Stromquist, W. G., 460.
 Strong, R. M., 264.
 Strowd, W. H., 630.
 Stubbs, E. L., 485.
 Stuckey, H. P., 538.
 Stuhlmann, H. C., 614.
 Sturgess, G. W., 880.
 Suematsu, N., 243.
 Summerby, R., 442.
 Summers, M. B., 618.
 Sundberg, R., 351, 853.
 Supplee, G. C., 274, 615.
 Sure, B., 108.
 Surr, G., 521.
 Sutherland, J., 737.
 Sutton and Sons, 138.
 Sutton, G. L., 731.
 Svedberg, T., 9.
 Swain, E. H. F., 340.
 Swales, E. R., 551.
 Swamikannu, L. D., 448.
 Swanson, C. O., 179.
 Swarthout, A. V., 291, 391.
 Sweet, A. T., 119.
 Sweet, G. B., 869.
 Swenchart, J., 98, 887.
 Swett, W. W., 371.
 Swezey, O. H., 656.
 Swingle, D. B., 334, 342, 651.
 Swingle, W. T., 235.
 Symons, S. T. D., 678.
 Szalágyi, K., 173.
 Szymanski, J. S., 51.
 Szymoniak, B., 395.
 Tacke, B., 215, 318, 627.
 Taft, L., 89.
 Takahashi, K., 644.
 Takahashi, N., 761.
 Talbot, F. B., 261, 756, 762.
 Tannehill, I. R., 618.
 Tanner, E. L., 831.
 Tansley, A. G., 142, 524.
 Tarr, L. W., 642.
 Taylor, A. D., 236.
 Taylor, G., 480.
 Taylor, G. B., 174, 175, 176, 177.
 Taylor, H. F., 466.
 Taylor, H. L., 361.
 Taylor, H. V., 242.
 Taylor, W. J., 180.
 Taylor, W. W., 501.
 Teale, F. H., 181.
 Tehon, L. R., 546.
 Tello, E., 269.
 Tempany, H. A., 535, 559.
 Tennent, R. B., 886.
 Terry, H. B., 453.
 Tharp, W. E., 214.
 Thatcher, L. E., 334.
 Thatcher, R. W., 700, 722.
 Thayer, P., 736.
 Thaysen, A. C., 617.
 Thiel, A. F., 846.
 Thillard, R., 232.
 Thjötta, T., 78.
 Tholin, T., 309.
 Thom, C., 355, 417, 431.
 Thomas, A. W., 113.
 Thomas, F. E., 12.
 Thomas, G., 595.
 Thomas, K., 756.
 Thomas, M. D., 18.
 Thomas, R., 436.
 Thomas, R. C., 347.
 Thomas, W., 614.
 Thompson, C., 511.
 Thompson, D. G., 282, 380.
 Thompson, H. C., 537.
 Thompson, J. B., 30.

- Thompson, L., 269.
 Thompson, M. C., 57.
 Thompson, M. McK., 820.
 Thompson, S. C., 879.
 Thompson, W. C., 678.
 Thompson, W. P., 35.
 Thompson, W. R., 57.
 Thoms, C. S., 245.
 Thomson, J. W., 251.
 Thomson, M. R. H., 653.
 Thornber, H., 327.
 Thornber, J. J., 699.
 Thorne, 894.
 Thorne, C. E., 334.
 Thornley, T., 13.
 Thornton, T., 437.
 Thorpe, E., 888.
 Thrachtenberg, H. L., 268.
 Throckmorton, R. I., 30.
 Tibbaut, E., 292.
 Tice, C., 231.
 Tiebout, G. L., 898.
 Tillery, R. G., 96.
 Tilley, F. W., 180.
 Tillmans, J., 753.
 Tillyard, R. J., 752.
 Tisdale, C. W. W., 275.
 Tisdale, W. B., 124, 298.
 Tisdall, F. F., 416, 417.
 Tisdall, S. F., 203.
 Titus, H. W., 97.
 Tochinal, Y., 224.
 Todd, F. H., 238.
 Toftemark, E., 437.
 Toit, H. S. du, 227, 442.
 Tolaas, A. G., 33.
 Tolley, H. R., 87, 383.
 Tolmie, S. F., 138, 748, 872, 880.
 Tompson, H. F., 335.
 Torrance, F., 874, 880.
 Torre, P. de la, 535.
 Toste, C. C. y, 837.
 Tothill, J. D., 51, 56.
 Toumey, J. W., 340, 542, 738.
 Tovar, M. N., 852.
 Tower, W. V., 157.
 Townsend, C. O., 134, 207.
 Townsley, T. S., 72.
 Tozer, F. M., 567.
 Trabue, E., 792.
 Trabut, L., 235.
 Tracy, W. W., 200.
 Trafford, F., 645.
 Trägårdh, I., 51.
 Traum, J., 377.
 Travassos, L., 281.
 Traverso, G. B., 244.
 Treadwell, F. P., 310.
 Treherne, R. C., 159, 348.
 Treidal, A., 798.
 Trelles, R. A., 814.
 Trench, A. D. le P., 647.
 Treoussart, E., 575.
 Trouvelot, B., 852.
 Trowbridge, E. A., 363, 364.
 Trowbridge, P. F., 66.
 Troy, H. C., 295.
 Tryon, R. H., 433.
 Truelle, A., 139.
 Trujillo Peluffo, A., 351.
 Trullinger, R. W., 98.
 Tryon, H., 49, 776.
 Tsuji, R., 239.
 Tucker, E. H., 159.
 Tucker, E. S., 200, 751.
 Tuckwiller, R. H., 675, 765.
 Tudor, H., 745.
 Tukey, H. B., 735.
 Tully, A. M. T., 669.
 Turinetti, L., 852.
 Turley, T. B., 718.
 Turner, C. W., 371, 372, 771.
 Turner, J. D., 572.
 Turrentine, J. W., 23.
 Turrill, W. B., 712.
 Tutin, F., 110.
 Twitchell, H. P., 386.
 Tyzzer, E. E., 485.
 Udden, J. A., 719.
 Uichanco, L., 458.
 Ulbrich, E., 532.
 Underhill, F. P., 612.
 Underhill, G. W., 155.
 Unger, L. J., 164, 165, 865.
 Ungerer, E., 810.
 Upshur, R. L., Jr., 627.
 Urbain, A., 722, 881.
 Vaile, R. S., 521.
 Valencia, F. V., 283.
 Valencia, G. R., 33.
 Valenti, G., 92.
 Valgren, V. N., 388, 786, 787.
 Vallée, C., 12, 709.
 Vallée, H., 875, 579.
 Vallez, H. A., 614.
 Vallot, J., 418.
 Van Alstine, E., 315, 525, 712.
 van Burgst, S., 51.
 Van Cleef, E., 618, 619.
 van den Berg, C., 741.
 Vandenbergh, H., 12.
 van der Bijl, P. A., 206, 417, 418, 454, 648.
 van der Lek, H. A. A., 451.
 van der Waal, G. A., 741.
 van der Wolk, P. C., 224.
 Vandevelde, A. J. J., 256.
 Van Dijk, J., 715.
 Van Dine, D. L., 700.
 Van Durme, 882.
 Van Fleet, W., 199, 541.
 van Hall, C. J. J., 343.
 van Harreveld, P., 441.
 van Hauten, A., 623.
 van Hoek, P., 93, 597.
 Van Hovenberg, H. W., 460.
 van Leersum, E. C., 562, 862.
 van Leeuwen, W. S., 470.
 Van Marle, D. J., 12.
 van Niekerk, M., 227.
 Van Norman, H. E., 396.
 Van Oye, P., 720.
 van Poeteren, N., 448, 451.
 Van Saceghem, R., 376, 683, 881, 883.
 Van Zwaluwenburg, R. H., 461.
 Varney, B. M., 115.
 Vaughan, R. E., 649.
 Vaughn, E. C., 732.
 Vavilov, N. I., 632.
 Vawter, L. R., 684.
 Vayssière, P., 851, 852, 853.
 Véchet, A., 222.
 Veeki, M., 775.
 Veitch, F. P., 114, 187, 205.
 Vener, B., 175.
 Venkatraman, T. S., 135.
 Ventre, J., 509.
 Verhoeven, W. B. L., 741.
 Verhulst, J. H., 208.
 Verzár, F., 470.
 Vestal, A. G., 141.
 Vestal, C. M., 477.
 Vilá, M. R. i, 875.
 Vickers, V. R. S., 226.
 Viehoever, A., 755.
 Viereck, H. L., 58.
 Vilá, M. R., i, 875.
 Vilcoq, 138.
 Villanueva, L. B., 339.
 Villedieu, 745.
 Vilmorin, P., 125.
 Vinall, H. N., 441, 848.
 Vincent, C. C., 839.
 Vischer, W., 42, 43.
 Viswanath, B., 511.
 Vitoux, 14, 311.
 Vladesco, R., 667.
 Voelcker, J. A., 435, 716.
 Vogel, I. H., 354.
 Voglino, P., 849.
 Vogné, L. de, 894.
 Völtz, W., 67, 68.
 Vosbury, E. D., 340.
 Voss, W. C., 688.
 Vries, O. de, 43.
 Waal, G. A. van der, 741.
 Wachter, W. L., 268.
 Waddell, J. A. L., 286.
 Wade, E. B. H., 886.
 Wade, J. S., 354, 464.
 Wadley, F. M., 660.
 Waentig, P., 68.
 Waggaman, W. H., 718.
 Wagner, H., 74.
 Wagner, K., 266.
 Wagner, P., 424, 437.
 Wahl, R. O., 766.
 Wakabayashi, S., 231.
 Wakefield, E. M., 239, 348.
 Wakeman, A. J., 801.

- Waksman, S. A., 356, 822.
 Waldmann, J., 774.
 Waldmann, O., 277, 485.
 Waldron, C. H., 731.
 Waldron, L. R., 330.
 Walker, F., 707.
 Walker, J. C., 345.
 Walker, S., 760.
 Walker-Tisdale, C. W., 275.
 Wallace, B. A., 97.
 Wallace, H. A., 788.
 Wallace, H. C., 400, 595.
 Wallace, J. S., 562.
 Wallace, R., 800.
 Wallace, S. T. D., 436.
 Wallén, A., 208.
 Waller, A. D., 571, 572, 800, 870.
 Waller, A. G., 590.
 Waller, H., 562.
 Walshe, F. M. R., 360, 669.
 Wälstedt, I., 730.
 Walster, H. L., 536.
 Walter, W., 861.
 Walton, C. F., jr., 508.
 Walton, G., 536.
 Wang, C. C., 801, 802.
 Wann, F. B., 723.
 Warburg, O., 798.
 Ward, F. E., 94.
 Ward, J. G., 137.
 Ward, J. S. M., 391.
 Ward, R., 89.
 Ward, R. DeC., 314.
 Wardlaw, H. S. H., 563.
 Wardle, R. A., 57.
 Waring, J. H., 539.
 Warner, D. C., 794.
 Warner, D. E., 575.
 Warner, K. F., 700.
 Warren, D. C., 58.
 Warren, E. R., 151.
 Warren, G., 598.
 Warren, G. F., 192.
 Warren, G. M., 891.
 Warren, S., 279.
 Washburn, R. S., 389.
 Waterman, H. C., 163.
 Waterman, W. G., 141.
 Waters, R., 240, 451.
 Waterston, J., 558.
 Watkins, W. I., 119.
 Watson, A., 360, 730.
 Watson, A. F., 357, 680.
 Watson, E. A., 485.
 Watson, F. E., 247.
 Watson, H., 766.
 Watson, J. A. S., 269.
 Watson, J. G., 175.
 Watts, F., 131, 226, 400.
 Way, A. E., 540.
 Wayman, M., 707.
 Weaver, J. E., 27, 28, 29.
 Weaver, L., 591.
 Weaver, L. A., 363, 364.
 Weaver, W. A., 653.
 Webster, J. F., 511, 512.
 Webster, R. W., 880.
 Webster, T. A., 824, 825.
 Weddel, W., & Co., Ltd., 276.
 Weeks, D., 98, 100.
 Weeter, H. M., 772.
 Wehrle, P., 711.
 Wehrwein, G. S., 893.
 Weichardt, W., 880.
 Weil, A., 572.
 Weimer, J. L., 325.
 Weinziel, J., 97.
 Weir, J. R., 150.
 Weiske, F., 820.
 Weiss, F., 846.
 Weiss, H., 64, 571, 670.
 Weiss, H. B., 225, 656, 661, 750.
 Weitz, B. O., 618, 619.
 Weitzel, A., 311.
 Welch, H., 334, 374.
 Welch, M. M., 17.
 Weld, I. C., 174.
 Weld, L. H., 58.
 Weldon, G. P., 853.
 Welker, W. H., 503.
 Wellhouse, W. H., 463.
 Wellington, R., 443.
 Wells, A. H., 569.
 Wells, H. G., 9.
 Wells, R. C., 720.
 Wells, S. D., 617.
 Wendt, W. A., 874.
 Werkman, C. H., 686.
 Wesenberg-Lund, C., 459.
 Wessels, P. H., 221.
 West, A. P., 109.
 West, C., 523.
 West, C. J., 290.
 West, E., 348, 661.
 West, M. E., 95.
 Wester, P. J., 91, 114, 300, 391.
 Westemeier, K., 35.
 Westgate, J. M., 640, 698.
 Westover, H. L., 531.
 Wetmore, A. S., 708.
 Wheatley, J., 562.
 Wheeler, R., 697.
 Wheldon, R. W., 636.
 Wherry, E. T., 525.
 Whetzel, H. H., 448.
 Whinyates, L., 9.
 Whipple, R., 257.
 Whitcomb, W. O., 327, 732.
 White, C. T., 31.
 White, E. A., 98, 100.
 White, J. W., 522.
 White, P., 693.
 White, P. B., 857, 858.
 Whitehouse, F., 674.
 Whiting, P. W., 456, 463.
 Whiting, R. A., 582.
 Whiting, W. A., 274.
 Whitley, E., 825.
 Whitnah, C. S., 99.
 Whitney, C. S., 85.
 Whitney, M., 620, 809.
 Whitson, A. I., 310.
 Whitson, A. R., 511.
 Whittaker, H. A., 97.
 Whitten, J. C., 640.
 Whyte, G. H., 380.
 Wiancko, A. T., 829.
 Wibeck, E., 142, 236.
 Wickson, E. J., 37, 139.
 Wickware, A. B., 687, 885.
 Wiessmann, H., 521, 522.
 Wiggans, R. G., 631, 729, 831.
 Wilcox, E. M., 648.
 Wilcox, E. V., 233.
 Wilcox, R. H., 894.
 Wilder, F. W., 491.
 Wiley, R. C., 810.
 Wilhelmi, J., 51, 661.
 Wilkansky, I., 798.
 Wilkansky, M., 798.
 Wilke, O., 278.
 Wilkins, S. D., 271.
 Will, E. G., 807.
 Willaman, J. J., 95, 553, 758.
 Wille, F., 69.
 Wille, J., 53.
 Williams, A. W., 80.
 Williams, C. B., 154.
 Williams, E. J., 414.
 Williams, G. M., 85.
 Williams, G. P., 478.
 Williams, G. W. M., 110.
 Williams, I. W., 58.
 Williams, L. C., 194.
 Williams, O. E., 880.
 Williams, R. R., 864.
 Williams, R. S., 176.
 Williams, R. W., 555.
 Williams, W. B., 751.
 Williams, W. L., 482.
 Williar, H. D., jr., 86.
 Willson, C. A., 169.
 Wilmot, G. A., 237.
 Wilsdon, B. H., 116.
 Wilson, 253.
 Wilson, A. C., 732.
 Wilson, B. D., 16.
 Wilson, B. S., 30.
 Wilson, C. H., 507.
 Wilson, C. P., 140.
 Wilson, F. T., 430.
 Wilson, G. F., 840.
 Wilson, J., 91, 391.
 Wilson, J. K., 124, 323.
 Wilson, M., 244.
 Wilson, R. N., 599.
 Willson, S. H., 522.
 Wilson, W., 1.
 Wilson, W. H., 762.
 Wiltshire, M. O. P., 166.
 Wimberly, L. C., 295.
 Winchester, H. B., 366.
 Windisch, W., 224.
 Winik, M., 798.

- Winkenwerder, H., 739.
Winkler, H., 222.
Winkler, M. R., 882.
Winslow, E. A., 465.
Winston, J. R., 340, 453, 746.
Winter, O. B., 168.
Wiprud, A. C., 388.
Wirt, F. A., 100.
Wise, F. B., 441, 508.
Withrow, G. M., 463.
Withrow, J. R., 490.
Withycombe, R., 169, 170.
Witte, H., 530, 634, 728.
Woglum, R. S., 52, 160.
Wolcott, G. N., 250, 558.
Wolcott, J. D., 89.
Wolf, C. G. L., 673.
Wolf, F. A., 740.
Wolfanger, L. A., 422.
Wolff, H. W., 596.
Wolff, W. H., 159.
Wolk, P. C. van der, 224.
Woll, F. W., 576.
Wollman, E., 866.
Wood, E. J., 261.
Wood, J. C., 157.
Wood, T. B., 871.
Woodbury, C. G., 336.
Woodcock, W. H., 888.
Woodfall, H. C., 381.
Woodger, J. H., 173.
Woodman, H. E., 871.
Woodroffe, H. B., 422.
Woods, C. D., 500.
Woods, F. W., 84.
Woods, K. S., 788.
Woodward, C. R., 789.
Woodward, E. G., 300.
Woodward, K. W., 444.
Woodward, S. M., 779.
Woodworth, H. E., 159.
Woofter, T. J., jr., 189.
Woolard, E. W., 618.
Wooley, J. C., 890.
Woolman, M. S., 95.
Wooton, E. O., 784.
Work, P., 538.
Wormald, H., 742.
Worsham, C. G., 396, 493.
Worsham, W. A., jr., 17, 712.
Wortley, E. J., 242.
Wrangell, M. von, 220.
Wright, A., 614.
Wright, A. H., 111.
Wright, C. H., 316.
Wright, L. H., 885.
Wright, S., 868.
Wright, W. G., 739.
Wright, W. H. (Canada), 639.
Wright, W. H. (Wis.), 19, 649.
Wurmser, R., 825.
Wyant, Z. N., 412, 466, 468.
Wyman, L., 399.
Wyon, G. A., 80.
Yard, R. S., 842.
Yarnell, D. L., 778, 888.
Yates, H. S., 652.
Yatsu, N., 265.
Yeatman, F. W., 258.
Yeh, Y. T., 32.
Yocum, L. E., 433.
York (Duke), 800.
Yoshida, T., 488.
Yothers, W. W., 351, 355.
Young, B. P., 459.
Young, C. J., 248.
Young, E., 295.
Young, E. C., 197.
Young, H., 175, 281.
Youngblood, B., 394, 675.
Zander, E., 51.
Zapparoli, T. V., 832.
Zavitz, C. A., 226, 392.
Zavitz, E. J., 541.
Zeasman, O. R., 185, 288.
Zederbauer, E., 236.
Zemach, S., 798.
Zeman, V., 850.
Zenghelis, C. D., 310, 415.
Ziegler, E. A., 896.
Ziemann, H., 277.
Zilva, S. S., 11, 61, 64, 567, 806.
Zimmerley, H. H., 335, 336.
Zimmerman, O. B., 100.
Zinsser, H., 375, 376.
Zook, L. L., 837.
Zucker, T. F., 203, 473.
Zundel, G. L., 545.
Zweigelt, F., 51.

INDEX OF SUBJECTS.

NOTE.—The abbreviations "Ala.Col.," "Conn.State," "Mass.," etc., after entries refer to the publications of the respective State experiment stations; "Alaska," "Guam," "Hawaii," "P.R.," and "V.I." to those of the experiment stations in Alaska, Guam, Hawaii, Porto Rico, and Virgin Islands; "Can.," to those of the experiment stations in Canada; and "U.S.D.A." to those of this Department.

"A. & M. Berry," new hybrid, Tex., 335.

Abaca heart and root rot, 43.

Abortion—

immunization, 483, 776.

in cattle, 483, 683, 773; Mo., 377.

in donkey and pony mares, 685.

in horses, 685.

in mares, Ky., 885.

in mares, occurrence in Great Britain, 178.

in sheep, Mich., 484.

in swine, 884; Mo., 378.

susceptibility of swine to, Mich., 582.

treatment with collargol, 277.

(See also *Bacterium abortus*.)

Acanthopsyche junodi, natural enemies, 247.

Acaris woodi and Isle of Wight disease, 464; U.S.D.A., 858.

Acarina, occurrence and distribution, 752.

Accessory food factors. (See Vitamins.)

Accounting, farm. (See Farm accounting.)

Acerentulus barberi n.sp., notes, 255.

Acerin, isolation and analyses, N.Y.State, 308.

Acetic acid, analysis, 114.

Acetone—

manufacture, bacteriology of, 617.

production from corncocks, 208.

Acid phosphate. (See Superphosphate.)

Acid production by bacteria, detection, N.Y. State, 431.

Acid rations, effect on pigs, Iowa, 363.

Acid-fast organisms, action of oils on, 579.

Acids—

amino. (See Amino acids.)

and bases, titration, 413.

bacterial tolerance to, N.C., 740.

fatty. (See Fatty acids.)

in soils, alkaline reaction, 320.

organic, formation by *Aspergillus niger*, 225.

organic, variation during anthocyanin formation, 723.

volatile, production by streptococci in starters, Iowa, 76.

volatile, production from corncocks, 208.

Acrodermia, relation to pellagra, 261.

Acrothecium spp., notes, 742.

Actinometers, standardization, 418.

Actinomyces—

chromogenus on sugar beets, 450.

scabies, notes, 847.

scabies, studies, 450.

Actinomycetes, culture media for studying, N.Y.State, 317.

Actinomycosis, pulmonary, in swine, 777.

Adsorption by soil colloids, 810.

Aecidium spp., notes, 845.

Aedes aegypti, notes, 661; P.R., 157.

Aedes calopus. (See *Stegomyia*.)

Aeginetia indica, notes, 45.

Aenoplegimorpha phytonomi, synonymy, 857.

Afforestation. (See Forestation.)

Agalaxy, contagious, of sheep and goat, 377.

Agave, determination of flexibility, 230.

Agave weevil, notes, 58.

Aggregates, road. (See Road materials.)

Agrarian—

movement in United States, 91.

reforms in Czecho-Slovakia, 92.

Agricultural—

chemistry. (See Chemistry.)

clubs, junior, clothing project, 697.

College, Southeastern, in England, 791.

colleges—

Canadian, entrance requirements and courses, 194.

curricula, 789.

(See also Alabama, Arizona, etc.)

colonization. (See Land settlement.)

commerce department of Chicago University, 800.

Commission, French, to Nigeria, 798.

conference in Illinois, editorial, 701.

cooperation—

in Belgium, 292.

in Denmark, 292.

in India, 895.

in Ireland, 91.

in Rumania, 895.

in Switzerland, 390.

in Yugoslavia, 495.

credit—

associations, organization, U.S. D.A., 388.

in France, 592.

in Iowa, plan, 494.

in Ontario, 493.

in Porto Rico, 592.

tabulation of bank loans, 592.

economics. (See Rural economics.)

education—

in Argentina, 897.

in Australia, 696.

in Belgian Congo, 392.

in Belgium, 94.

Agricultural—Continued.

education—continued.

- in Canada, 599.
- in Denmark, 295.
- in England, 897.
- in France, 497.
- in Germany, reorganization, 897.
- in Scotland, 597.
- in Union of South Africa, 597.
- in Veterans' Bureau schools, vocational, 399.
- in West Indies, 194.

value, 896.
 vocational, for disabled service men, 193.

vocational, junior projects in, 897.
 (See also Agricultural colleges, Agricultural instruction, Agricultural schools, and Vocational education.)

engineering, research in, 98.

(See also Engineering.)

experiment stations. (See Experiment stations.)

export industry of Argentina, 292.

extension—

- among negroes, U.S.D.A., 297.
- cooperative, U.S.D.A., 597.
- demonstration work, treatise, 296.
- in Canada, 194.
- in Florida, 95.
- needs and maintenance, 792.
- notes, Guam, 793.

index for farmers, 89.

instruction—

- in Ontario, 696.
- in Spain, 392.
- project method, 193.
- school farm in, 94.
- Smith-Hughes method, 597.
- vocational, teaching methods, 393.
- (See also Agricultural education.)

journals, new, 600, 800.

labor—

- in early nineteenth century, 494.
- in Japan, 390, 494.
- in Scotland, 91.
- in Sweden, 693.
- utilization, Mo., 387.
- wages, 593.

land, valuation, 593.

laws in Massachusetts, 694.

legislation, international yearbook, 392.

machinery, export packing, 383.

mechanics section of French institute, 889.

meteorology, present status, 208.

policy for Great Britain, 784.

possibilities in Philippines, 91.

problems, Congressional action, 595.

products—

- cost of production, 590; Miss., 590; N. J., 590.
- cost of production, methods of study, U.S. D. A., 291.
- (See also specific crops.)

Agricultural—Continued.

products—continued.

- freight rates in France, 694.
- marketing. (See Marketing.)
- prices, U.S.D.A., 192.
- producers, authorizing, association, 90.
- tariff revision for, 495.
- tariff schedule in Italy, 595.
- trade in Italy, 92.

research—

at experiment stations, editorial, 101.

in Great Britain, 294.

Institute in Palestine, 798.

national policy, 301.

resources of Philippine provinces, 391.

school, high, of Berlin, 497.

schools and vineyard practices in Alsace, 391.

schools in Czecho-Slovakia, 497.

statistics—

collection and use, 496.

foreign, handbook, U.S.D.A., 293.

graphic presentation, Mont., 695.

of Australia, 497, 895.

of Austria, 92, 293.

of Brazil, 496.

of California, 389.

of Canada, 496.

of Denmark, 92, 93, 496.

of Dutch Colonies, 93.

of Egypt, 497, 895.

of Finland, 93.

of France, 392.

of India, 93, 293.

of Ireland, 92.

of Japan, 497.

of Montana, 695.

of Netherlands, 93.

of New South Wales, 694.

of Scotland, 496.

of Switzerland, 392, 497.

of Union of South Africa, 696, 895.

of United Kingdom, 696.

of Uruguay, 392.

of Wisconsin, 695.

tenancy. (See Land tenancy and Land tenure.)

Wages Board, history, 389.

Agriculture—

Act in Great Britain, 595.

and industry, balance between, 387.

and irrigation in tropical climates, treatise, 282, 584.

and taxes in France, 894.

degree course in, 790.

Department of. (See United States

Department of Agriculture.)

essays on, 295.

in ancient Greece and Rome, 494.

in Belgium, government aid, 292.

in Canada, 694.

in Colombia, 391.

in Italian colonies, 92.

Agriculture—Continued.

- in Japan, 390.
- in Missouri, history, 495.
- in Netherlands, 597.
- in Norway, 898.
- in Switzerland, 591.
- milpa system, 595.
- modern, encyclopedia, 898.
- place in American Association for Advancement of Science, 2.
- textbook, 95.
- tropical, treatise, 32.
- unemployment insurance in, 495.

Agriotes obscurus, life history, 462.

Agronomy, degree course in, 791.

Agronomy station of Yonne, 294.

Agrotis segetum, papers on, 51.

Alahee tree in Hawaii, 42.

Alanin, effect on starch hydrolysis, 707.

Alaska College, notes, 298.

Alaska Stations, notes, 97.

Albizia lebbek, notes, 737.

Alcohol—

- effect on botulinus toxin, 361.
- industrial, manufacture, 114.
- manufacture from carob beans, 509.
- manufacture from cassava, 808.
- manufacture from corncocks, 208.
- manufacture from grape marc, 509.
- (See also Amyl, Butyl, and Methyl alcohol.)

Aleurocanthus woglumi in Jamaica, summary, 246.

Aleyrodes vaporariorum. (See White fly, greenhouse.)

Alfalfa—

- amino-acid content, 504.
- as affected by calcium, Ky., 816.
- as forage crop, Mass., 30.
- as green manure, 320; U.S.D.A., 531.
- as nitrogenous fertilizer, 518.
- as orchard cover crop, U.S.D.A., 531.
- as pasture crop, Mont., 364; U.S.D.A., 767.
- as silage crop, U.S.D.A., 531.
- as sod crop, U.S.D.A., 130.
- as soiling crop, U.S.D.A., 531.
- barium in, Colo., 28.
- breeding in Sweden, 728.
- chopped, analyses, Tex., 675.
- culture, 31; U.S.D.A., 831.
- culture experiments, 131; U.S.D.A., 724.
- culture in India, 728.
- diseases, 546.
- effect on testes of cockerels, 271.
- fertilizer experiments, Kans., 30, 435; Mo., 326.
- hay at different stages, tests, 195; Kans., 475.
- hay, feeding value, Wyo., 676.
- hay, liming experiments, Md., 321.
- hay, making and storing, U.S.D.A., 531.
- hogging down, S.C., 768.
- leaf weevil, parasite of, identity, 857.
- manuring experiments, Kans., 30.
- meal, analyses, Mich., 168; N.H., 674; Tex., 675.

Alfalfa—Continued.

- meal, preparation, U.S.D.A., 531.
- mill, machinery for, U.S.D.A., 531.
- need for more in Michigan, Mich., 598.
- proteins in, 801.
- rotation experiments, Kans., 435.
- seed, Italian, identification, 732.
- seed production, 31.
- seeding experiments, Mo., 326.
- silage. (See Silage.)
- straw, feeding value, U.S.D.A., 531.
- strontium in, Colo., 28.
- tea, feeding value, U.S.D.A., 531.
- time of cutting, Kans., 435.
- utilization, U.S.D.A., 531.
- varieties, Mich., 633; Tex., 329.
- webworm, control, 153.

Algae—

- carbon fixation by, 824, 825.
- chlorophyll formation in darkness, 724.
- green, nitrogen fixation by, 723, 824, 825.
- marine, permeability, 126.
- photosynthesis in, 824, 825.

Alkali—

- content of soils, relation to crops, 512.
- effect on action of pectin, 110.
- fusions, 203.
- lands in Iraq, 512.
- soils, effect on concrete, 85.
- soils, solubility of anions in, 421.

Alkaloids in plants, function, 324.

Alloxysta erythrorhæa, hyperparasite of aphids, 463.

Alluvial soils of Fiji, 316.

Almond die-back, 544.

Almond disease, control, 850.

Alternaria—

- grossulariæ*, notes, 242.
- pomicola*, n.sp., description, 243.
- solani*, notes, 451, 845, 847.

Alternaria on tobacco leaves, 344.

Aluminum—

- as affected by nitrification and sulfofication, Ohio, 430.
- hydroxid, preparation, 806.
- silicate, effect on wheat, 717.

Alunite, fertilizing value, 626.

American—

- Association for the Advancement of Science, agriculture in, 1.
- National Live Stock Association, proceedings, 872.
- Society of Agricultural Engineers, 97.

Amino acids—

- effect on hydrolysis of starch, 707, 708.
- method of separation, 802.
- of blood, relation to milk proteins, 74.
- of feeds, determination, 504.

Amino sugar of Chinese edible birds' nests, 802.

Amitosis in bone cells, types, 263.

Ammonia—

- determination, 615.
- formation, relation to soil condition, 812.
- new reaction of, 310.

Ammonia—Continued.

- nitrogen, determination, 12.
- production by streptococci, 274.

Ammonification as affected by straw, 424.

Ammonium—

- bicarbonate, action on moor soils, 215.
- bicarbonate, composition and action, 820.
- carbonate, transformation with gypsum, 819.
- nitrate, composition and action, 820.
- sulphate—
 - and sodium ammonium sulphates, comparison, 819.
 - as nitrogenous fertilizer, 519, 520.
 - effect on availability of iron, N.J., 526.
 - effect on availability of rock phosphate, Ohio, 429.
 - manufacture, studies, 819.
 - nitrate, composition and action, 820.
 - nitrification, 516.
 - toxic effect on plants, Mass., 21.

Amoeba meleagridis, notes, 687.

Amorbia humerosana, notes, 749.

Amyl alcohol, recovery, 808.

Amylase, activation, effect of H-ion concentration, 325.

Amylase activity, effect of antiseptics, 707.

Anaerobe jar, modification, 180.

Anaerobes—

- culture in Petri dishes, 681.
- culture, microscopic method, 412.
- isolation and culture, 179.
- isolation, principles, 773.

Anametis griseus, notes, Mich., 457.

Anaphylaxis reactions of milk proteins, 9.

Anastatus bifasciatus, parasitism by, 457.

Ancylostoma caninum—

- hemolysin from, 379.
- in foxes, 886.

Andrena perplexa, mouth parts, studies, 560.

Andropogon purpureo-sericeus, value for poor land, 30.

Andropogon sorghum. (See Jowar.)

Anemia as affected by secretin, 760.

Anesthesia in treatment of botulism, 64.

Animal—

- breeding. (See Hybridization and specific animals.)

- cells, mitochondria in, 824.

- chromosomes. (See Chromosomes.)

- diseases—
 - control in Kansas, 178.
 - control in Massachusetts, 681.
 - evolution, treatise, 374.
 - gulde for farmer, 276.
 - in Canada, 880.
 - in Ceylon, 880.
 - in Egypt, 773.
 - in France, 479.
 - in India, 276, 479, 480.
 - in Rhodesia, 880.
 - in Saxony, 479.
 - in Union of South Africa, 881.

Animal—Continued.

diseases—continued.

textbook, 276.

(See also specific diseases.)

- fats, factors affecting composition, Kans., 476.
- fats, international trade, 675.
- fibers. (See Fibers.)
- growth, studies, 672.
- industry laws in Michigan, 480.
- power on the farm, 99.
- protein, value for laying hens, 875; Ky., 875.
- shelters, heating systems for, 491.
- tissues, deproteinization methods, 564.
- tissues, nutritive properties, 161.

Animals—

- avitaminous, sensitiveness to poisons, 470.
- domestic, disease of genital organs, 482.
- domestic, pathological anatomy, treatise, 681.
- domestic, physiology, treatise, 681.
- food, excess of fat in, 565.
- fur-bearing, laws, U.S.D.A., 151.
- fur-bearing, trapping, 455.
- immature, breeding, effect on growth, Mo., 362.
- slaughter-house, internal parasites, 882.
- wild, of Louisiana, 554.
- (See also Cattle, Live stock, Mammals, Sheep, etc.)

Anions, antagonistic action, 126.

Anopheles—

- maculipennis*, embryological studies, 459.
- occidentalis*, seasonal history, 856.
- spp., notes, P.R., 157.

Anophelines, arsenic as larvicide, 856.

Anophelines of Denmark, 459.

Antagonism, 425.

Antagonism between anions, 126.

Antestia lineaticollis, life history and control, 537.

Anthelmintics, use for fowls, 687.

Anthocyanin formation—

- in Pisum, 433.
- variation of organic acids during, 723.
- (See also Pigmentation.)

Anthonomus—

- grandis*. (See Cotton-boll weevil.)
- nebulosus*, life history and habits, 463.

Anthraxnose of various plants, 239.

(See also specific host plants.)

Anthrax—

- bacilli killed by alcohol-ether, immunizing value, 774.
- bacilli, sensitization due to, 881.
- beef serum for, 579.
- cutaneous vaccination, 375.
- human, serum treatment, 375.
- infested skins and hair, disinfecting, 480.
- notes, 773.
- occurrence in Great Britain, 178.

Anthrax—Continued.

- prophylaxis in leather industry, 682.
- symptomatic. (See Blackleg.)
- vaccination, anaphylactic reactions from, 180.

Antibodies, essential identity of, 375.

Antineuritic vitamin. (See Vitamin.)

Antiscorbutic. (See Scurvy.)

Antiscorbutic vitamin. (See Vitamin C.)

Antixerophthalmic vitamin. (See Vitamin A.)

Ants—

- Argentina, in citrus groves, control, U.S.D.A., 160.
- Argentina, in France, 851.
- house, notes, 50.
- Macedonian, habits, 560.
- Mermis parasite on, 752.
- white. (See Termites.)

Anuraphis helichrysi, control, 855.

Apanteles hyphantria, notes, 51.

Apanteles spp., parasitism by, 457.

Aphaereta auripes, parasitism by, U.S.D.A., 249.

Aphelenchus sp., notes, 447.

Aphelinus mali—

- introduction into France, 560.
- introduction into New Zealand, 752.
- introduction into Uruguay, 351.

Aphicide, tests, Mass., 50.

Aphid eggs, revolution of embryo, significance, 154.

Aphidius granarius, parasitism by, 158.

Aphids—

- affecting apples in British Columbia, 154.
- hyperparasites of, bionomics, 463.
- spermatogenesis, 246.

Aphis—

- brassicae*. (See Cabbage aphis.)
- gossypii*. (See Melon aphis.)
- maidis-radiciis*. (See Corn root aphis.)
- maidis*, method of study, 245.
- maidis*, notes, Guam, 748.
- mali*, fire-blight distributor, 348.
- pomi*. (See Apple aphis.)
- rumicis*, biological studies, 246.
- sorbi*, control, N.Y.State, 351.
- spp., biology, 855.
- woolly, parasite of, 752.

Aphycus lounsburyi—

- notes, 53.
- parasitism by, 749.

Apiculture. (See Beekeeping.)

Apis mellifica, mouth parts, studies, 560.

Apotettix, new linkages in, Kans., 476.

Appalachian Forest Experiment Station, notes, 900.

Apparatus—

- autoclave, modification, 201.
- automatic registering, for soil analyses, 814.
- distillation, 111.
- for anaerobic culture, description, 180.
- for collecting and weighing carbon dioxide, 672.

Apparatus—Continued.

- for color measurement, 111.
- for demonstrating absorption of oxygen, 432.
- for determining ammonia nitrogen, 12.
- for determining basal metabolism, 671.
- for determining catalase, 503.
- for determining free and combined CO₂ in mine water, 805.
- for determining melting point of fats, 13.
- for determining opacity of liquids, 111.
- for determining respiratory exchange in man, 166.
- for distilling liquids, 414.
- for fractional distillation, 414.
- for measuring shortening value, 258.
- for measuring tractive effort, 585.
- for preventing superheating in moisture tester, 414.
- for reducing milk and fruit juices to powder, 11.
- Haldane gas analysis, improved, 201.
- lixiviator, description, 23.
- microcolorimeter, new, 805.
- piston cylinder, 631.
- pollination, for sugar cane, 135.
- rotary digester for testing bagasse, 15.
- sodium lamp, new type, 111.
- "thermos" flask, uses, 614.
- trap to prevent loss of iodine, 805.

Apple—

- anthracnose, 47, 144, 552.
- aphids, biology, 855.
- aphids, control, 154.
- aphis, green, control, N.Y.State, 351.
- aphis, rosy, control, N.Y.State, 351.
- aphis, woolly, control, 852.
- aphis, woolly, parasites of, 351, 560.
- bitter pit, factors affecting, 47.
- bitter rot canker, studies, 148.
- bitter rot, notes, 741.
- black rot, 849.
- blight, Mont., 651.
- blister canker, control, 47; N.Y.State, 348.
- blotch, 543.
- blotch canker, studies, 148.
- bud moths, 749.
- canker, control, 551.
- canker, notes, 741.
- collar rot, cause, 745.
- cork disease, cause, 452.
- crowngall, 543.
- diseases, 447.
- drought spot and related diseases, 452.
- fire-blight control, 451.
- juice, clarification, U.S.D.A., 617.
- leaf rollers, 749.
- leafhopper, cause of tipburn, 549, 744.
- leafhopper, fire-blight distributor, 348.
- leafhopper, notes, 51.
- mildew, downy, control, 646.
- mildew, notes, 741.
- mildew, powdery, control, 144.
- mildew, powdery, in South Africa, 453.

Apple—Continued.

- pollen and pistils, studies, 433.
- pollen, viability and potency, 39.
- root rot, 543.
- rust control, 451.
- rust, notes, 543.
- rust survey in Virginia, 243.
- scab, notes, 243, 543, 552, 741.
- scald, cause and prevention, 149.
- shoots, hardiness, relation to pentosan content, 443.
- sooty blotch, 552.
- spurs, analyses, Mo., 335.
- thrips injury, 657.
- trees, bracing, Ohio, 736.
- trees, depth of planting studies, 735.
- trees, nonproducing, in France, 139.
- trees, root development, 38.
- trees, treatise, 735.

Apples—

- and vegetable marrows, recipes, 258.
- biennial bearing, change of year, 735.
- breeding experiments, 39.
- cost of production, 139.
- crab. (See Crab apples.)
- decay in cold storage, 544.
- fertilization, importance, Del., 639.
- hardiness, determination, 539.
- history and improvement, 337.
- inheritance of yielding ability, 234.
- long pruning, 640.
- new, origin, 640.
- pectin content, factors affecting, 207.
- pollination studies, 840.
- production in Hood River Valley, Oreg., 234.
- pruning experiments, Del., 640; N.J., 536.
- pruning, types, N.H., 335.
- relation of tree type to productivity, 841.
- respiration in, 337.
- sampling by weight, accounting forms, 391.
- spotted, diagnosis of fungi from, 242.
- spraying, 552.
- spraying experiments, 646.
- spraying schedules, Colo., 55; U.S.D.A., 54.
- storage studies, 338.
- transpiration studies, 128.
- varieties for stock, Iowa, 334.
- varieties in Canada, 138.
- winter injury, 139.
- winter study, 839.
- yield and trunk circumference, correlation, 539.
- York Imperial, eulogy, 841.

Apricot die-back, 544.

Apricot scab, 453.

Apricots—

- dried, energy value, 859.
- in Morocco, 140.
- Sclerotinia on, 47.

Arabis alpina, gall formation in, 741.*Aracercus fasciculatus*. (See Coffee-bean weevil.)

Archips—

- argyrospila*, summary, 156, 855.
- obsoletana*, studies, N.Y.Cornell, 465.
- rosaceana*, notes, 749.

Architects' handbook, 691.

Arduenna strongylina, notes, La., 281.

Areca nut, taenical value, 687.

Argas—

- persicus*, life history and control, 778.
- reflexus*, chloropicrin gas for, 465.

Arginin, effect on starch hydrolysis, 708.

Argyrophora abietana, notes, Mich., 457.

Arithmetic, household, textbook, 95.

Arizona—

- Station, notes, 195, 699.
- University, notes, 195, 395, 699.

Armillaria mellea—

- control, 746.
- description, Wash., 449.
- on *Rhododendron*, 150.

Army worm—

- fall, control, 660.
- fall, summary, 247.
- notes, 51.

Arrowroot, culture experiments, Guam, 726.

Arsenic—

- as anopheline larvicide, 856.
- content of soils, 814.
- copper dust, value, 846.
- effect on soil bacteria, Mont., 343.
- supply of Nova Scotia, 51.
- white, value in Bordeaux mixture, Mass., 50.

Arsenical sprays, spreading and adherence, Minn., 852.

Arsenicals, comparative value, Mich., 443.

(See also Calcium arsenate and Lead arsenate.)

Arsilonche albovenosa, studies, N.Y.Cornell, 465.

Arthropods, Antarctic land, occurrence and distribution, 752.

Arzama obliqua, studies, N. Y. Cornell, 465.

Ascaridole determination in chenopodium oil, 311.

Ascarids, treatment for, 685.

Ascaris—

- lumbricoides* extracts, 379.
- megaloccephala* as affected by thymol, 885.

Ascochyta—

- lycopersici*, notes, 451.
- phaseolorum*, notes, 845.

Ascochyta on peas, 241.

Ascomycetes, morphology and life history, 722.

Ashes, coal and coke, as fertilizers, 220.

(See also Wood ashes.)

Asparagus—

- as affected by rock salt, 732.
- canned, bacterial flora, 859.
- canned, bacteriological studies, Kans., 467.
- selection studies, 335.

Aspen canker, 454.

Aspergillus in sugar solution, studies, 206, 417.

Aspergillus—

- niger*, formation of organic acids by, 225.
- niger*, growth, effect of salt proportions, 629.
- sp., notes, 451.
- spp. in corn meal, 356.

Asphodelus luteoides n.sp., notes, 721.

Aspidiotus—

- destructor* on coconut, Guam, 748.
- pernicius*. (See San José scale.)

Asses—

- Catalonian, description, 875.
- international trade, 675.

Association of Official Seed Analysts, 731.

Astragalus sinicus, decomposition in rice fields, 715.

Athous haemorrhoidalis, life history, 462.

Atmospheric moisture. (See Humidity.)

Autoclave, modification, 201.

Avocado twig die-back, 845.

Avocados—

- in Florida, 40.
- insects affecting, 351, 458, 748.
- variety tests, Hawaii, 640.
- vitamin content, 667.

Azalea root rot, 150.

Azotobacter, nitrogen-fixing power, effect of metabolism products, 714.

Baby beef. (See Cattle, beef.)

Bacillary dysentery in lambs, 776.

Bacillus—

abortus agglutinins, transmission from cow to calf, 882.

abortus, elimination with milk, 882.

(See also *Bacterium abortus* and Abortion.)

acetoethylicum, fermentation of corn-cob sirup by, 208.

acetoethylicum, studies, 781.

acidophilus, therapeutic application, 870.

amylovorus, notes, 543.

atroscpticus, notes, 847; Can., 146.

botulinus—

American strains, purity, 262.

from canned spinach, 361.

in hog cholera serum, 379.

notes, 684.

spores, thermal death point, 670, 763.

strains, typing, 670.

toxin, inoculation test, 262.

carotovorus—

biology, 449.

fermentative activity, N.C., 740.

notes, 44.

caulivorus, notes, 451.

chauvaei, characteristics, 480.

coli, as affected by H-ion concentration of medium, 324.

coli, viability in carbonated beverages, 754.

communis, notes, 684.

enteritidis, cause of food poisoning, 571.

Bacillus—Continued.

influenzae, growth studies, 78, 79, 80.

lathyri, notes, 447.

manniticus, notes, 804.

melitensis. (See *Bacterium melitensis*.)

mesentericus in canned asparagus, Kans., 467.

mesentericus, viability in carbonated beverages, 754.

musarum n.sp., notes, 850.

necrophorus. (See *Necrobacillosis*.)

oleraceae, notes, 451.

paratyphosus, viability in carbonated beverages, 754.

pyogenes, notes, 777.

radicicola, longevity, Mo., 315.

(See also Nodule production.)

solanacearum, notes, 451.

sporogenes, notes, 684.

subtilis in canned asparagus, Kans., 467.

supestifer, notes, Ind., 583.

teres, notes, 777.

Bacteria—

acid production by, agar slants for detecting, N.Y.State, 431.

anaerobic. (See Anaerobes.)

as source of vitamin B., 760.

cause of deterioration of sugars, 206, 417, 418.

fermentative activity, N.C., 740.

growth, as affected by vitamins, 80, 866.

in home-canned foods, 859.

in milk, soil, etc. (See Milk, Soils, etc.)

methods of culture, technique, N.C., 740.

nutrition, studies, 78.

pathogenic, air carriage of, 773.

pathogenic, physiology, N.C., 739.

pentose-destroying, fermentative ability, 503.

thermal death point, relation to pH, N.C., 740.

thermal death time curves, 561.

tolerance to acids, N.C., 740.

vitamin requirements, 759.

Bacterial—

content of stomach as affected by saliva, 862.

emulsions, nephelometric determination, 312.

inhibition by metabolic products, 324.

stain, rose bengal, N.Y.State, 431.

suspensions, determining number, 412.

Bacteriologic culture media. (See Culture media.)

Bacteriology—

agricultural, 124.

agricultural, treatise, 221.

international catalogue, 222.

laboratory manual, 201.

manual, 578.

principles, textbook, 374.

treatise, 78, 880.

Bacteriosis of banana, 850.

Bacterium—**abortus—**and *Bacterium melitensis*, com-

parison, 775.

growth, effect of carbon dioxide

tension, 277.

notes, Mo., 378.

pathogenicity for monkeys, 775.

susceptibility of swine, Mich., 582.

(See also *Bacillus abortus*.)*angulatum*, fermentative activity, N.C.,

740.

campestre, fermentative activity, N.C.,

740.

casei, mannitol production by, 804.*citri*. (See Citrus canker.)*citriputeale*, synonymy, 244.*cloacae* in decomposing salmon, 754.*coli commune*, notes, 777.*glycineum*, notes, N.C., 740.*lactis acidii*, inoculation of sauerkraut

with, 502.

malvacearum, notes, 544.*melitensis* and *Bacterium abortus*, com-

parison, 775.

melitensis, pathogenicity for monkeys,

775.

pullorum infection in fowl, Mass., 81.*pyocyaneum*, notes, 777.*sojae*, notes, N.C., 740.*tabacum*, fermentative activity, N.C.,

740.

teutium on sugar beets, 450.*tularensis*, studies, 151, 662.*tumefaciens*, notes, 543.*tumefaciens*, studies, 49.*typhosum*, viability in carbonated bev-

erages, 754.

vascularum, notes, 45, 148.*vascularum* on sugar cane, 450.*vascularum*, studies, 242.*volutans*, notes, 617.*vulgare*, notes, 777.*welchii*, notes, 684.

Bagasse analysis, rotary digester for, 15.

Bagworms, natural control, 247.

Bakerophoma sacchari, notes, 45.

Bakewell, R., work in animal production,

872.

Balanophora on coffee, 343.

Balanisia cyperi n.sp., description, 344.

Balsam diseases, 454.

Balsam, windfall injuries, 645.

Bamboo disease survey in India, 544.

Banana—

bacteriosis, 850.

beetle borer, studies, 751.

borer in Fiji, 245.

bunchy top, control, 453.

disease in Porto Rico, 48.

freckle disease, notes, Hawaii, 647.

root disease, 746.

wilt in Philippines, 745.

Bananas—

feeding value, Hawaii, 679.

studies in India, 640.

variety tests, Guam, 734.

Bank loans to farmers, U.S.D.A., 786.

Barberry eradication, 447; Mont., 343;

U.S.D.A., 546.

Barberry eradication in Illinois, 546.

Barberry in Iowa, history, 449.

Barium—

in plants, Colo., 28.

process in sugar manufacture, 616.

Bark beetles—

in British Columbia, control, 159.

new, descriptions, Miss., 461.

studies, 560.

Barley—

as affected by chromium salts, 716.

as affected by sulphur, 428; Wash., 427.

as green manure, 320.

ash content, 329.

breeding, dominant Mendelian charac-

ters, 438.

breeding experiments, 633.

chop, analyses, Can., 167; Tex., 675.

cultural directions, Wash., 437.

culture experiments, 436; U.S.D.A., 724.

culture on peat soil, 216.

disease survey in India, 544.

diseases and pests, 52.

feeding value, 674.

fertilizer experiments, 436.

flower and grain, development, 132.

hulls, analyses, Mich., 168.

improvement by selection, 830.

irrigation experiments, 436.

leaf stripe, control, 545.

lime v. chalk for, 716.

mutation, behavior in crosses of, 531.

Piricularia on, 448.

protein content, effect of time of seed-

ing, 438.

root system as affected by fertilizers,

132.

silage. (See Silage.)

sprouting respiration in, 224.

v. corn, feeding value, 271.

varieties, Mich., 633.

varieties, classification, N.Y.Cornell.

831.

varieties, effect of fertilizers, 729.

varieties, German brewing, tests, 831.

varieties, new, description, 531.

variety tests, 131, 227, 436, 531, 633;

Kans., 435; Mo., 326; Mont., 327;

Wash., 438.

winter races from spring crosses, 632.

yields, Mont., 327.

yields in Australia, 132.

Barn ventilation, 99, 587.

Barn ventilation, outtake flue design, 99,

491.

Basic slag. (See Phosphatic slag.)

Basidiomycetes from Philippines, 554.

Basket making around Oxford, 788.

Bean—

anthracnose, control, 844.

anthracnose, resistant strains, 547.

anthracnose, studies, N.Y.Cornell, 648.

blight, notes, 646.

rust, notes, 741.

Bean—Continued.

- seedlings, growth in wind, 827.
- seedlings, variant, vascular anatomy, 27.
- seedlings, vascular anatomy, 825, 826.
- weevil, response to atmospheric moisture, 661.

Beans—

- as affected by borax, 123; Conn.State, 322.
- breeding experiments, 633.
- canned, bacterial flora, 859.
- canning studies, U.S.D.A., 664.
- carob, alcohol production from, 509.
- cost of production, 389; Miss., 590.
- culture experiments, 436.
- disease resistance, inheritance, 546.
- heat injury in Colorado, 145.
- hybridization experiments, 430.
- jack, as cover crop, Guam, 726.
- longevity of seed, 537.
- manuring experiments, N.H., 318.
- patani, notes, Guam, 726.
- proteins, nutritive value, 564.
- Robust, characteristics, Mich., 132.
- selection, mass and individual, 734.
- varieties, Mich., 633.
- variety tests, Guam, 726; Hawaii, 633; Mont., 327.
- (See also Mungo, Tepary, and Velvet beans.)

Bedbugs, tularaemia transmission by, 662.

Beech, southern, forests of New Zealand, 542.

Beef—

- cost of production, Iowa, 366.
- dressing and cutting on the farm, Iowa, 477.
- international trade, 675.
- production in Corn Belt, U.S.D.A., 269.
- scrap, analyses, Can., 168.
- serum, use against anthrax, 579.
- (See also Cattle.)

Beekeeping—

- handbook, 254.
- in Canada, Can., 254.
- in New Hampshire, 159.
- in the South, 160.
- in time of Aristotle, 463.
- papers on, 58.
- popular account, 463.
- principles, treatise, 463.

Bees—

- acarine disease, notes, 464, 858.
- disease act in Florida, 457.
- disease control, 752.
- heat production in winter, U.S.D.A., 254.
- honey-gathering abilities, 196.
- Isle of Wight disease, 464, 857, 858; U.S.D.A., 858.
- Nosema disease, U.S.D.A., 858.
- number and length of daily trips, Iowa, 349.
- pupal cell, 51.
- rôle in pollination, 840.
- (See also Honey.)

Beeswax, extraction of, 114.

Beet—

- curly leaf, causative agent, 658.
- leafhopper, control, 854.
- leafhopper, life history, 854.
- leafhopper, relation to curly leaf, 658.
- leaves and spinach, differentiation, 311.
- molasses, desugarization, comparison of agents, 616.
- pulp, dried, analyses, 871; Mich., 168; N.H., 675; Tex., 675.
- seed, sale in France, 637.
- sugar manufacture, technology, 417.
- sugar sirup, examination, 507.
- vinasse, feeding value, 67.
- webworm, control, 153.

Beetles—

- Hopkins host-selection principle, 353.
- Japanese, control, 661.
- Japanese, quarantine, 751.
- new cerambycid, 461, 661.
- new myrmecophilous, 159.
- of Central Europe, 51.

Beets—

- culture on peat soil, 216.
- effect on following crop, 336.
- field or fodder. (See Mangels.)
- irrigation experiments, Mich., 537.
- lime requirements, R.I., 233.
- lithium in, Colo., 29.
- manganese in, Colo., 29.
- sugar. (See Sugar beets.)
- variety tests, Mont., 327.

Berberis spp., identification, 721.

Beriberi—

- nervous lesion in, 360, 669.
- review of literature, 257, 869.
- treatment, tikitiki extract for, 569.

Beriberi-like disease in mammals, 668.

Berries. (See Fruits, small, and Raspberries, Strawberries, etc.)

Berseem yields in Australia, 132.

Beverages—

- carbonated, viability of colon-typhoid group in, 754.
- imitation fruit juice, 113.

Bibliography of—

- agriculture in New Zealand, 789.
- apple pollen, 39.
- apple sooty blotch, 552.
- beriberi, 257.
- birds of South Dakota, 245.
- cereal rust in Iowa, 449.
- climate of South America, U.S.D.A., 17.
- crane flies, N.Y.Cornell, 57.
- dates, insects affecting, 558.
- disinfecting skins and hair, 480.
- Drosophila melanogaster*, 661.
- egg yolk formation, 173.
- eggs, preservation, 877.
- Eimeria pfeifferi* in pigeons, 886.
- Ephydra subopaca*, N.Y.Cornell, 751.
- fat chemistry, 613.
- foxes, parasites of, 686.
- grain pests, parasitic hymenoptera on, 558.

Bibliography of—Continued.

- hickory borer, painted, 250.
- Ipidae, North American, Miss., 461.
- life zones of Alabama, U.S.D.A., 245.
- milk, fat content varied by feed, 680.
- milk secretion, relation to diet, 878.
- moss rose origin, 842.
- negro migration, 191.
- nutrition, 295.
- parthenogenesis, occurrence and causation, 222.
- pear pollen, 39.
- phosphatids, 11.
- plastids, origin, 722.
- potato wart disease, 550.
- Pulvinaria innumerabilis*, 246.
- rhinoceros beetles, 560.
- rural sanitation, 782.
- scurvy in World War, 261.
- soil acidity in India, 812.
- stable fly, 661.
- strychnin, toxicity to rodents, 655.
- sugar cane froghopper blight, 154.
- sugar cane varieties, 835.
- taste, physiology and psychology of, 563.
- tractor books, 385.
- trypanosomes of cattle, 484.
- tsutshgamushi disease carrier, 560.
- tuberculosis, 182.
- Typha insects, N.Y.Cornell, 465.
- vitamins, 256, 469.
- vitamins and rickets, 257.
- wood waste, utilization, 114.
- woods of the world, 737.
- Bichlorid of mercury. (*See* Corrosive sublimate.)
- Billbugs, food plants and distribution, 560.
- Biochemical methods, manual, 612.
- Bioclimatics, intercontinental problems, 114.
- Biological survey of Alabama, U.S.D.A., 245.
- Biology, elementary, textbook, 696.
- Bird treaty act, migratory, U.S.D.A., 565.
- Birds—
 - color production in feathers, 73.
 - community refuges for, U.S.D.A., 456.
 - desert, in Great Basin, 851.
 - houses and nesting boxes, 245.
 - in Queensland, 49.
 - migratory, refuges and shooting grounds, 851.
 - native, Mallophaga of, 456.
 - North American gulls and terns, life histories, 151.
 - North American, migration, 456, 851.
 - of Australia, 49.
 - of Great Britain, and eggs, 151.
 - of South Dakota, 245.
 - on a farm, 349.
 - outdoor study, 456.
 - physiology of reproduction, 267.
 - portraits and habits, treatise, 456.
 - protection, directory of officials for, U.S.D.A., 151.

Birds—Continued.

- raising in orchards, 741.
- respiration calorimeter experiments, 172.
- territorial dominion, 245.
- Birds' nests, Chinese edible—
 - amino sugar of, 802.
 - proteins of, 801.
- Black—
 - disease of sheep, etiology, 281.
 - locust poisoning of chickens, 686.
 - scale, biological control, 749.
 - scale in California, parasite of, 53.
- Blackberries, breeding experiments, 39.
- Blackberry crowngall, 543.
- Blackhead in turkeys, 485, 687.
- Blleg—
 - immunization and therapy, 579.
 - immunization with germ-free filtrate, 180.
 - toxin and toxic endocarditis, 481.
- Blacksmithing, farm, treatise, 287.
- Blepharipa scutellata*, parasitism by, 457.
- Blepharospora terrestris*, new name, 241.
- Blissus leucopterus*. (*See* Chinch bug.)
- Blister beetles in Kansas, U.S.D.A., 158.
- Blood—
 - amino acids, relation to milk proteins, 74.
 - analysis, methods, 807.
 - and blood vessels in scurvy, 474.
 - calcium determination in, 416.
 - chlorin content after ingestion of salt, 174.
 - constituents as affected by muscular exercise, 475.
 - deproteinization, methods, 564.
 - dried. (*See* Dried blood.)
 - magnesium determination in, 416.
 - nonprotein nitrogen in, 113.
 - of children, calcium distribution in, 259.
 - of children, phosphoric acid distribution in, 259.
 - of rats, effect of fasting and lack of vitamin B, 62.
 - picture in scurvy, 762.
 - plasma, inorganic phosphorus in, 506.
 - potassium determination in, 416.
 - serum, diffusible calcium in, 203.
 - sodium determination in, 416.
- Blowflies on meat, protection against, 57.
- Blue grass—
 - fertilizer experiments, Mich., 518.
 - grass, germination, papers on, 731.
- Blueberries—
 - as affected by salt, 733.
 - culture, U.S.D.A., 140.
 - culture in Minnesota, 539.
- Body, human, as working mechanism, 756.
- Bogs, oxygen content of water, effect of cloudiness, 632.
- Boll weevil. (*See* Cotton-boll weevil.)
- Bollworm. (*See* Cotton bollworm.)
- Bombyx mori*. (*See* Silkworm.)

Bone—

- cells, structure and multiplication, 263.
- marrow of cat, histological study, 263.
- meal, nitrification, 516.

Bonnato comta, parasitism by, 247.

Books on—

- agricultural education, vocational, teaching, 393.
- agricultural extension, 296.
- agriculture, 95.
- agriculture and irrigation, 282.
- agriculture, tropical, 32.
- animal diseases, 276.
- animal diseases, evolution, 374.
- animals, domestic, pathological anatomy, 681.
- apple trees, 735.
- architecture and building, 691.
- arithmetic, household, 95.
- bacteriology, 78, 578, 880.
- bacteriology, agricultural, 124, 221.
- bacteriology, principles, 374.
- beekeeping, 254, 463.
- biochemical methods, 612.
- biology, elementary, 696.
- birds, 245.
- birds of Great Britain, 151.
- birds, portraits and habits, 456.
- blacksmithing, 287.
- botany, 322.
- botany, agricultural, 95, 221.
- bridges, 286.
- butter making, 275.
- cellulose hydrolysis, 203.
- cement, 888.
- cheese making, 275.
- chemical analysis, 111.
- chemistry, analytical, 310.
- chemistry, household, 296.
- chemistry of engineering, 778.
- chemistry, organic, 9.
- chemistry, pharmaceutical organic, 202.
- chemistry, physiological, 859.
- chemistry, vocational, 95.
- clothing, 95.
- colloids, chemistry of, 501.
- colloids, formation, 9.
- colorimetric analysis, 709.
- community organization, 789.
- concrete construction, 688.
- concrete designing, 85.
- cotton, 391.
- crop production, 29.
- crops and tillage, 696.
- cytology, 823.
- dairy chemistry, 113.
- dairying, 73.
- Denmark, 292.
- diagnostic methods, 880.
- disinfection, 310.
- economic conditions in Philippines, 895.
- economy, national, 590.
- education, social objectives, 193.
- engineering construction, 888.
- engineering, cost accounting, 486.
- engineering, structural drafting and design, 886.

Books on—Continued.

- engines, internal combustion, 891.
- enzymes, chemistry of, 9.
- export packing, 383.
- farm bureau movement, 386.
- farm management, 693.
- farming, 696.
- farming costs, 493.
- fauna of British India, 461.
- Federal farm loan system, 388.
- feeding stuffs, 70.
- fertilizers, manufacture, 518.
- fish culture, 720.
- flowers, culture, 138.
- food chemistry, 560.
- food products, source, chemistry, and use, 859.
- foods, analyses and energy values, 161.
- forage crops in Denmark, 227.
- forest botany, 221.
- forest laws, French, 141.
- forest mensuration, 341, 444, 739.
- forestry, 236.
- fruits, insects affecting in Germany, 458.
- gardening, 838.
- gasoline, 87.
- geography, economic, 295.
- geography, political, 697.
- grange, work of, 695.
- health education in rural schools, 194, 898.
- histology, vegetable, 322.
- home economics, 792.
- home economics, elementary, 296.
- immunity, vaccination, and serum therapy, 880.
- insect life, 456.
- insects, 49.
- insects and injuries from, 456.
- insects, relation to man, 152.
- insects, transformation, 456.
- irrigation in tropical Africa, 584.
- irrigation in tropical climates, 282.
- jute culture and manufacture, 134.
- jute in Bengal, 533.
- landscape gardening, 236.
- leather manufacture, 313.
- lipoids, rôle in infection and immunity, 276.
- mammals, South African, 245.
- market analyses, 693.
- marketing, 289, 593.
- marketing, methods and policies, 594.
- meat-packing houses, 491.
- meteorology, 711.
- microscopy, chemical, 201.
- motor fuels, 87.
- motor trucks, 890.
- Nonpartisan League, 292.
- nut growing, 40.
- oils, vegetable, 202.
- parasites of animals, classification, 456.
- physiology of domestic animals, 681.
- physiology, principles, 255.
- pigeons, flying homer, 173.
- plant breeding, 829.

Books on—Continued.

- plant culture, 720.
 - plant diseases, 238.
 - plant diseases and pests, Calif., 238.
 - plant diseases, nonparasitic, 843.
 - plant growth and soil conditions, 809.
 - plant life in New Zealand, 222.
 - plant movements, 528.
 - plant physiology, 126.
 - poultry, 95.
 - poultry breeding, 272.
 - poultry keeping, 768.
 - preventive medicine and hygiene, 859.
 - project method of teaching, 193.
 - prophylaxis of animal diseases, 579.
 - protein metabolism, 563.
 - protozoology, 78.
 - red lead, use in paint, 688.
 - rural reconstruction, 596.
 - schools, Federal aid for, 193.
 - schools, rural, supervision, 392.
 - serum diagnosis, 276.
 - sewerage and sewage disposal, 891.
 - sheep breeding, 270.
 - soil conditions and plant growth, 809.
 - soils, 511.
 - South American States, 789.
 - sterilization, 310.
 - structural design, 486.
 - timberlands, American, valuation, 444.
 - tractor engines, 890.
 - trapping, 455.
 - tree biology, 221.
 - trees of North America, 737.
 - tuberculosis, 182.
 - vegetable biology, 221.
 - vegetables, culture, 138.
 - veterinary hygiene, 773.
 - veterinary medicine, 178, 880.
 - veterinary service in the war, 479.
 - vitamins, 256, 863.
 - water resources, 687.
 - wheat plant, 837.
 - wood, 779.
 - wool, 391.
 - wool combing, 72.
 - Yosemite National Park, 41.
 - zoology for medical students, 773.
- Borax—**
- effect on crops, Conn.State, 322; S.C., 717.
 - in fertilizers, effect on crops, 123.
- Bordeaux mixture—**
- arsenic in, value, Mass., 50.
 - preparation, U.S.D.A., 235.
- Borna disease, etiology, 485.**
- Bot flies of Mesopotamia, 59.**
(See also Ox-warble and Warble fly.)
- Botany—**
- agricultural, treatise, 95, 221.
 - college, treatise, 322.
 - forest, treatise, 221.
- Bothryoxysta curvata**, hyperparasite of aphids, 463.
- Botryodiplodia theobromae**, notes, 845.
- Botrytis—**
- antherarum trifolii*, notes, 832.

Botrytis—Continued.

- cinerea*, notes, 44.
 - sp., notes, 145, 447, 544, 844, 849.
 - tulipae*, N.Y.Cornell, 654.
- Bots, treatment for, 685.**
(See also Bot flies.)
- Botulinus toxin—**
- determination and type, 467.
 - precipitation with alcohol, 361.
 - studies, 669.
- Botulism—**
- and encephalitis lethargica differential diagnosis, 262.
 - anesthesia in treatment, 64.
 - cause and treatment, Mich., 468.
 - human, bacteriological diagnosis, 262.
 - in swine, relation to hog cholera immunization, 378.
 - responsibility and prevention, 571.
- Boxwood leaf midge, life history and control, 750.**
- Boxwoods of commerce, 445.**
- Boxwoods, West Indian, identity, 843.**
- Boys, boarding school, size and weight, 563.**
- Boys' clubs—**
- in Kansas, 194.
 - in New Zealand, 793.
 - notes, Guam, 793.
 - relation to rural homes, 598.
 - status and results, U.S.D.A., 393.
- Brachysporium trifolii**, notes, 743.
- Bracon erythrogaster**, parasitism by, N.Y. Cornell, 250.
- Brain, human, zinc and copper content, 861.**
- Bran.** (See Corn bran, Wheat bran, etc.)
- Bread making, studies, Can., 162.**
(See also Flour.)
- Breeding.** (See Heredity, Hybridization, Inbreeding, Plant and Animal breeding.)
- Bremidae, keys, 463.**
- Brewers' dried grains, analyses, N.H., 675; Tex., 675.**
- Brick pavements, impact tests, U.S.D.A., 285.**
- Bridges, economics of, treatise, 286.**
- British—**
- Goat Society, yearbook, 874.
 - National Institute of Agricultural Botany, 398.
- Broccoli, variety tests, Del., 640.**
- Brome grass—**
- clones and sibs, studies, N.Dak., 330.
 - culture experiments, U.S.D.A., 724.
 - physical characters, N.Dak., 330.
- Broom—**
- corn, yields, Guam, 726.
 - plant, historical account, 532.
- Brown coal, origin in middle Germany, 219.**
- Browntail moth—**
- in Nova Scotia, 51.
 - parasites of, distribution, 457.
- Brucella, new genus, studies, 775.**
- Bruchus—**
- obtectus*. (See Bean weevil.)
 - rufimanus*, cooperative campaign against, 159.
- Bryobia pratensis.** (See Clover mite.)

- Bryophyllum, regeneration in, 433.
 Bud moths, notes, 749.
 Buckwheat—
 analyses, Can., 168.
 decomposition rate in soil, N.Y. Cornell, 212.
 middlings and hulls, analyses, Mich., 168.
 varieties, Mich., 633.
 variety tests, Mont., 327.
 yields in New Jersey, 225.
 Bud worm injurious to apple trees, Ky., 157.
 Buffalo tree-hopper, notes, Mich., 457.
 Buffer solution for colorimetric comparison, 804.
 Builders' handbook, 691.
 Building—
 construction, types, heat loss through, 691.
 material standards, 285.
 materials, heat conductivity, 86.
 materials, properties, 891.
 Bulbs and bulb bloom, Can., 235.
 Bulls, genital infections in, 882.
 (See also Sires.)
 Bumblebees—
 of Illinois, keys, 463.
 rôle in pollination, 840.
 Bunostomum—
 phlebotomum, notes, La., 281.
 trigonocephalum in sheep, 685.
 Bureau of Economics and Social Intelligence publications, 590.
Bustomum phlebotomum extracts, experiments, 379.
 Butter—
 adulteration, detection, 13, 14.
 control scheme in Ireland, 772.
 efficient marketing, 594.
 factors affecting quality, 680.
 fat. (See Milk fat.)
 from whey cream, 772.
 imports into Great Britain, 276.
 international trade, 675.
 making experiments, 275.
 making, manual, 275.
 making on the farm, 772.
 rancidity, 109.
 retail, grade claimed and actual grade, 177.
 vitamin A content, 357, 680.
 Butterflies, common, leaflet, 247.
 Buttermilk—
 condensed, analyses, Tex., 675.
 feeding value, Ind., 574.
 testing, 680.
n-Butyl alcohol manufacture, by microbiology of, 617.
Byturus tomentosus, spraying for, 461.
 Cabbage—
 aphis, notes, 51.
 as vitamin source for chicks, Kans., 478.
 black rot organism, tolerance to acids, N.C., 740.
 blackleg, studies, Iowa, 342.

Cabbage—Continued.

- breeding experiments, Del., 639.
 Chinese, mosaic disease, 148.
 clubroot, control, Va., 648.
 cost of production, Miss., 590.
 culture on peat soil, 216.
 effect of preceding crop, 336; R.I., 233.
 foot rot, control, 543.
 hardening process in, Mo., 827.
 hardness, varietal differences, 838.
 heart rot, notes, 741.
 irrigation experiments, Mich., 537.
 maggot, control, 51, 248.
 seed stalk weevil, studies, 354.
 sun-dried, vitamin content, 359.
 yellows, 543.
 yellows, control, Va., 648.
 yellows, resistant strains, Iowa, 344.
 yellows, studies, Iowa, 342.
 Cacao—
 black rot, 44.
 culture in Colombia, 391.
 die-back, 845.
 disease in Ecuador, 149.
 pod rot and coconut bud rot, comparison, 453.
Cacoezia franciscana, life history, 56.
 Cactus, prickly-pear—
 insects affecting, 656.
 seeds, germination tests, 33.
 Cake fertilizers. (See Oil cake and organic materials.)
 Calcium—
 arsenate, insecticidal value, Mich., 443.
 arsenite, preparation and application, 613.
 as affected by nitrification and sulfification, Ohio, 430.
 assimilation as affected by cod liver oil, 566.
 assimilation, effect of dry *v.* fresh green plant tissue, 566.
 carbonate, effect on biochemical processes of soil, 714.
 carbonate, effect on sulfification, Ohio, 429.
 compounds, effect on plant growth, Ky., 816.
 compounds on adobe soils, use, 521.
 content of serum, relation to rickets, 165.
 cyanamid, composition and action, 820.
 cyanamid fertilizer spreaders, tests, 188.
 cyanamid, nitrifiability, 516.
 cyanamid, preparation, 20.
 cyanamid, studies, 20, 21.
 cyanid for gopher control, 455.
 deficient diet, effect, 472.
 determination in blood, 416.
 determination in feces, 417.
 determination in presence of magnesium, 310.
 determination in serum, 203.
 determination in urine, 417.
 diffusible, of blood serum, 203.

Calcium—Continued.

- distribution in blood of children, 259.
- effect on eggs and hens, 876.
- function in plant growth, 433.
- importance in nutrition, 259.
- nitrate, composition and action, 820.
- of milk, relation to casein digestion, 863.
- oxid, available, in lime, 114, 310.
- removal from soil, N.Y.Cornell, 210.
- salts in milk, effect of heat, 802.
- silicate, effect on wheat, 717.
- sulphate. (See Gypsum.)
- sulphid, effect on plants, 544.
- (See also Lime.)

Calendra pertinax, studies, N.Y.Cornell, 465.

Calf meals, analyses, Can., 168; Mich. 168.

California Station, notes, 599, 699.

California University, notes, 298, 599, 699, 794, 899.

Callimorpha fulvicosta, notes, Ky., 157.

Calliphora vomitoria, notes, 51.

Calves—

- feeding, Iowa, 371.
- feeding experiments, U.S.D.A., 765.
- milk substitutes for, Mo., 371.
- protein requirements, 764.
- wintering, U.S.D.A., 765.

Cambium, significance in physiological problems, 128.

international trade, 675.

Campoplex pilosulus, habits, 51.

Canada Grain Act, amendments, 694.

Canadian—

- Institutions, staff changes in, 397.
- Society of Technical Agriculturists, 300.

Canals, irrigation. (See Irrigation.)

Canary breeding and management, 555.

Cancer, serum diagnosis, 276.

Cane beetle, mealy, life history, 159.

Cane seed, ground, feeding value, Kans., 478.

(See also Sugar cane.)

Cannas, edible—

- culture experiments, Guam, 726.
- manuring, Hawaii, 633.

Canned foods, bacteria in, 859.

Canned foods, standards for, 15.

Canning—

- crop industry, research, 336.
- initial temperature, relation to exhaust, pressure, and vacuum, U.S.D.A., 663.
- of fish, 466, 664.
- of foods, U.S.D.A., 208.
- principles, 60.
- studies at experiment stations, 608.

Cantaloups. (See Muskmelons.)

Cantharis reticulata, notes, U.S.D.A., 158.

Canvas, treated, water resistance, 187.

Capillara sp. in sheep, 685.

Carabao. (See Water buffalo.)

Carbohydrate production in plants, biochemistry, 522.

Carbohydrates of copra meal, nature of, 803.

Carbolic acid, effect on plants, 544.

Carbon—

- accumulation in soil, rate, Mo., 315.

Carbon—Continued.

- activation, 203.
- bisulphid, anthelmintic value, 685.
- content of soil organic matter, 709.
- dioxid effect on germination of grain, 323.
- dioxid elimination as index to basal metabolism, 672.
- dioxid, fertilizing value, 321.
- dioxid formation, relation to soil moisture, 813.
- dioxid in mine water, determination, 805.
- dioxid nutrition of plants, relation to manure, 424.
- dioxid output in walking, 870.
- dioxid percentages for reversal of geotropic curve, 528.
- dioxid production by streptococci, 274.
- dioxid tension effect on *Bacterium abortus* growth, 277.
- fixation by algae, 824, 825.
- tetrachlorid, anthelmintic value, 282, 685.
- tetrachlorid for hookworm in dogs, 686.

Carbonic acid—

- action on soil silicates, 821.
- fertilizing values, 720.

Carbon-nitrogen ratio in soils, 715.

Carbons, decolorizing—

- comparative values, 12, 507.
- effect on colloids and color of cane juice, 508.

Cardamon disease survey in India, 544.

Carnation flower buds, rate of growth, N.J., 536.

Carob beans, manufacture of alcohol from, 509.

Carpenter worm, notes, 750.

Carpocapsa pomonella. (See Codling moth.)

Carrot—

- bacterial rot, 44.
- disease, new, Mass., 43.
- leaf curl, cause and control, 153.
- leaf tip scorch, 647.
- seed, vitamin A content, 357.

Carrots—

- as affected by sulphur, 822.
- canned, bacterial flora, 859.
- cost of production, Miss., 590.
- irrigation experiments, Mich., 537.
- sun-dried, vitamin content, 359.
- variety tests, Mont., 327.
- yields, 533.

Carrhamus tinctorius, anthracnose of, 239.

Cascara tree in British Columbia, 843.

Casing—

- alkaline hydrolysis, 612.
- digestion and absorption, 863.
- digestion experiments, 67.
- in diet, antirachitic value, 473.
- of cow's and human milk, 261.

Caseinogen, hydrolysis, 112.

Cassava—

- flour, detection, 13.
- meal, feeding value, Hawaii, 674.

Cassava—Continued.

- starch, analyses, 467.
- starch, manufacture of alcohol from, 808.
- tubers, Gloeosporium on, 647.

Cassavas—

- culture experiments, Guam, 726.
- fertilizer experiments, 634.
- seeding experiments, 634.
- variety tests, 226, 634; Hawaii, 633.

Cassia as food substitute, 755.

Cassytha, parasitism by, 343.

Castor—

- bean disease survey in India, 544.
- beans, culture, 109.
- oil, chemistry and uses, 109.
- oil, production, 636.

Catalase—

- determination, apparatus for, 503.
- reaction, 10.

Caterpillars attacking cedar cones, 660.

(See also Tent caterpillar.)

Cats—

- bone marrow, histological study, 263.
- cuterebra larvae from, 686.
- diseases of, treatise, 276.

Cattle—

- Aberdeen-Angus, origin and development, 766.

Ayrshire, origin and history, 175.

beef, cost of production, Iowa, 366.

beef, feeding experiments, 168; Kans., 366; Mont., 364; N.Mex., 169; U.S. D.A., 675.

(See also Calves, Cows, and Steers.)

breeding, 269, 674, 872.

breeding, community, 878.

breeding for milk increase, 273.

breeding in Canada, 872.

breeds, growth and development, 872.

cost of maintaining, Mich., 577.

daily distance traveled on prairie pasture, N.Dak., 367.

dairy. (See Cows.)

disease, undiagnosed, in New York, 82.

diseases, relation to public health, 281.

(See also specific diseases.)

distribution in South America, 269.

feeding, N.J., 273.

feeding experiments, 168, 765, 873; Kans., 366; Mont., 364; N.Mex., 169, 173; U.S.D.A., 675.

(See also Cattle, beef, Calves, Cows, and Steers.)

glands, hemicellulose in, 69.

Guernsey, 175.

identical twins in, 872.

in China, 573.

inheritance of belting spotting, 268.

international trade, 675.

Japanese, body and form, 270.

Jersey, inheritance of color markings, Ky., 372.

judging, Wis., 74.

Cattle—Continued.

lice, control, Mich., 559.

loss by foreign bodies in digestive tract, 882.

maintenance requirement, 168.

market, two-day, at Chicago, 894.

neutrality regulation in, 74.

ovaries, corpora lutea in, 266.

plague. (See Rinderpest.)

poisoning. (See Live stock poisoning and specific plants.)

protein requirements for growth, 764.

raising in Colombia, 391.

registering in Friesland, 878.

Shorthorns in Scotland, 72.

sterility studies, Mich., 482.

tick eradication. State laws and court reports, U.S.D.A., 281.

(See also Ticks.)

treatment to prevent ox-warble infestation, 684.

(See also Calves, Cows, Heifers, and Steers.)

Cattleys, insects affecting, 741.

Cauliflower, hardening process in, Mo., 827.

(*Cecidomyia*) *Mayetiola destructor*. (See Hessian fly.)

Cedar—

rust, notes, 543.

rust on apples, control, 451.

rust survey in Virginia, 243.

tree eradication in apple-growing sections, 243.

western red, of British Columbia, 236.

Cedrela n.spp., descriptions, 644.

Cedrela toona, culture, 445

Celery—

blight, control, 543.

blight, late, spraying experiments, 844.

diseases, N.J., 547.

hardening process in, Mo., 827.

Cell vacuoles in roots, origin, 823.

Cells, autoxidizable constituent, 110.

(See also Plant cells.)

Cellulose—

digestibility, 68.

fermentation, 69, 70.

hydrolysis, theory and practice, 203.

rôle in plant life, 722.

Cement—

kilns, potash recovery from, 220.

treatise, 888.

(See also Concrete.)

Cephaleuros mycoidea, notes, 845.

Cephalosporium sacchari—

notes, 45, 647.

on corn, 547; Del., 239.

Cercospora—

angulata, notes, 243.

beticola on sugar beets, 450.

coffeicola, notes, 647.

kopkei, notes, 45.

personata, synonymy, 648.

spp., notes, 451, 845.

vaginae, notes, 647.

Cercospora—*acerina*, notes, 44.*persica*, morphology and systematic position, 239.

Cereal—

by-products, chaff content, formula, 71.

diseases, Kans., 448.

diseases, notes, 448.

(See also *specific hosts*.)

rust, control, Mont., 343.

seed, treatment, 449.

smut, control, 545.

smut, germination, relation to H-ion concentration, Mo., 344.

(See also Smut, Corn smut, Wheat smut, etc.)

Cereals—

culture experiments, 131.

fungus diseases on, 239.

Helminthosporium on, 742.

in Bulgaria, analyses, 30.

nutritive properties, 161.

production in Spain, 696.

research on, 30.

varieties, new, description, 531.

(See also Grain and Barley, Oats, Wheat, etc.)

Ceresa bubalus. (See Buffalo tree-hopper.)

Cestode hemolysins, 379.

Ceutorhynchus quadridens, studies, 354.*Chabertia ovina* in sheep, 685.

Chalcidoidea, phytophagous, list, 857.

Chalk v. lime for barley and wheat, 716.

Chamiso brush, feeding value, N.Mex., 365.

Chard, canned, bacterial flora, 859.

Charips victrix, hyperparasite of aphids, 463.

Charlock, eradication, 37.

Chasmodon apterus, parasitism by, 158.

Chaulmoogra oil, action in leprosy, 579.

Cheese—

bacteria in, microscopic study, 177;
N.Y.State, 479.

Canadian, analyses, 772.

control scheme in Ireland, 772.

different kinds, analyses, 276.

from milk of fruit-fed cows, 276.

imports into Great Britain, 276.

international trade, 675.

making experiments, 275, 680.

making, manual, 275.

Swiss, making, bacterial culture in, 772.

yields, calculating, 879.

Chemical—

analysis, qualitative, treatise, 111.

structure and physiological action, 202.

Chemistry—

analytical, treatise, 310.

clinical, laboratory manual, 201.

for engineers and manufacturers, treatise, 778.

household, laboratory outline, 296.

of food and human nutrition, 355.

of nutrition, 255.

organic, methods, 9.

Chemistry—Continued.

pharmaceutical organic, treatise, 202.

physiological, treatise, 859.

vocational, treatise, 95.

yearbook, 1921, 9.

Chenopodium oil—

anthelmintic value, 686.

ascaridole determination in, 311.

Cherimoya, native home, 842.

Chermes cooleyi in England, 53.*Chermes cooleyi*, notes, 558.

Cherries—

composition as affected by fertilizers, 736.

storage studies, 338.

winter study, 839.

Cherry—

fruit fly, summary, 57.

leaf scorch, notes, 741.

Monilia, specialization in, 48.

Chestnut blight resistance, 150.

Chestnuts, replacement of, 445.

Chicken nematodes, studies, 84.

Chicken serum, antipneumococcus substances in, 775.

Chicken-pox vaccine, value, 485.

Chickens—

bantam breed, standard varieties, U.S. D.A., 769.

black locust poisoning, 686.

body temperature of breeds, 769.

digestion and nitrogen-balance trials, 173.

Rhode Island Reds, growth rate, 768.

standard varieties, U.S.D.A., 172.

(See also Chicks, Fowls, Hens, and Poultry.)

Chicks—

cabbage as vitamin source for, Kans., 478.

day-old, grain as sole feed, Kans., 478.

feeding and health, Wash., 498.

feeding experiments, Guam, 764; Mo., 370.

newly hatched, temperature, 769.

nutrient requirements, 171.

Chicory coffees, analyses, 416.

Chiggers, life history and control, U.S.D.A., 255.

Children—

backward, effect of vitamin rich diet, 868.

basal metabolism, standards, 261.

calcium distribution in blood, 259.

fecal flora, bacteriological study, 571.

food requirements. (See Infants, feeding.)

health books for, 194, 898.

phosphoric acid distribution in blood, 259.

protein requirements, 756.

(See also Boys, Girls, and Infants.)

Chili die-back, studies, 743.

Chili disease survey in India, 544.

Chilies. (See also Peppers.)

Chilo simplex, control, 458.

- Chimneys—
 construction, U.S.D.A., 386.
 for house heating boilers, 692.
- Chinch bug—
 bionomics, U. S. D. A., 658.
 in Indiana, 53.
 method of study, 245.
 notes, Ohio, 351.
- (*Chloridea*) *Heliothis obsoleta*. (See Cotton bollworm.)
- Chlorin content of blood after salt ingestion, 174.
- Chlorin in organic matter, determination, 311.
- Chlorodinitrobenzene, effect on plants, 544.
- Chloroform, efficiency against hookworms, 184, 185.
- Chlorophyll—
 colloidal, action of light on, 825.
 formation by algae in darkness, 724.
- Chloropicrin—
 action on *Argas reflexus*, 465.
 effect on plants, 544.
 use against termites, 656.
 use as insecticide, 852.
- Chondriomes in microorganisms, 127.
- Chondriosomes—
 in living cells, studies, 823.
 varieties in plant cells, 824.
- Chorizagrotis auxiliaris*, control, 153.
- Chorthophila brassicae*, control, 248.
- Chorthophila brassicae*, notes, 51.
- Chromium salts, action on barley, 716.
- Chromosomes—
 relation to segregation of heredity characters, 267.
 relation to somatic characters, 223.
 relationships in wheat, 430.
 X, elimination by X-rays, 673.
- Chrysanthemum leaf bronzing, 447.
- Chrysomphalus dictyospermi*, control in Italy, 559.
- Chrysophyctis endobiotica*—
 life history, 744.
 notes, 450, 847.
- Chrysopidae, biology, 458.
- Chrysops discalis*, tularaemia transmission by, 152.
- Cicada, periodical, notes, 458.
- Cicada, periodical, studies, 853.
- Cider preservatives, 897.
- Cider, value and preservation, 207.
- Cigarette beetle, destruction by heat and bezzin, 252.
- Cimex americana*, notes, 51.
- Cimex lectularius*. (See Bedbugs.)
- Cineraria foot rot, 544.
- Citric acid—
 content of milk, 615.
 effect on germination of rust spores, 846.
- Citrus—
 black fly in Jamaica, summary, 246.
 blast and black pit, 244.
 brown rot, control, 651.
- Citrus—Continued.
 canker eradication, 48, 544, 850.
 canker in Hawaii, 244.
 diseases in China and Philippines, 746.
 diseases in Porto Rico, 149.
 (See also Orange, Lemon, etc.)
 foot rot, 44.
 grove pests, control, 351.
 groves, beneficial fungi in, 245.
 hybrid, new, Eustis limequat, 40.
 insects affecting, 558.
 leaves, permeability studies, 432.
 Macrosporium on, 348.
 orchards, decline, 642.
 pink disease, 44.
 pink disease, distribution, 652.
 red scale, control in Italy, 559.
 scab, control, 48; U.S.D.A., 746.
- Citrus fruits—
 abscission, 529.
 coloring, 339.
 export from South Africa, cause of waste, 652.
 peel, vitamin A in, 567.
 tear stain, 453.
 withertip, 453.
 (See also Oranges, Lemons, etc.)
- Cladiinae, new species, 661.
- Cladosporium*—
carpophilum, notes, 453.
citri, notes, U.S.D.A., 746.
fulvum, control, Va.Truck, 336.
fulvum, notes, 451.
 sp., notes, 544.
- Clasterosporium degenerans*, morphology and systematic position, 239.
- Claviceps purpurea*—
 notes, 239, 322.
 on Manitoba wheat, 240.
- Clay—
 composition, studies, 620.
 distribution in Appalachian Mountains, 487.
 suspensions, formation of layers in, 810.
- Climate—
 effect on sugar beets, 115.
 evolution in northwest Europe, 314.
 modifying, 418.
 of Morocco, 712.
 of South America, bibliography, U.S.D.A., 17.
 (See also Meteorology.)
- Climatic—
 changes evident in peat deposits, 317.
 conditions, relation to diet, 561.
 cycles and tree growth, 27.
- Climatological data. (See Meteorological observations.)
- Clostridium sporogenes*, viability in carbonated beverages, 754.
- Clothes moths, notes, 51.
- Clothing project, elementary, 697, 792.
- Clothing, treatise, 95.
- Cloudiness, effect on oxygen content of bog water, 632.

Clover—

- bur, notes, Guam, 726.
- crimson, hogging down, S.C., 768.
- crimson, liming experiments, Md., 321.
- culture on peat soil, 216.
- Egyptian. (*See* Berseem.)
- Japan, liming experiments, 426.
- little known, culture experiments, 634.
- mite, control, 161.
- nutrient requirements, 716.
- red, as forage crop, Mass., 30.
- red, as nitrogeous fertilizer, 518.
- red, as pasture for pigs, Mont., 364.
- red, breeding experiments, 633.
- red, rotation experiments, 436.
- red, rust, notes, 741.
- red, seed color and inheritance, 634.
- red, seed color characteristics, 732.
- red, seed, home-grown *v.* imported, 729.
- red, seed identification, 732.
- red, seed production, 832.
- red, selection, 831.
- red, variation and inheritance in, 438.
- rust on mammoth and red clover, 449.
- sweet. (*See* Sweet clover.)
- varieties, Mich., 633.
- white, wilt, studies, 743.

Club work. (*See* Boys' clubs and Girls' clubs.)

Cnaphalocrosis medinalis on rice, 458.

Coal—

- and coke ashes as fertilizers, 220.
- dust, effect on crops, 221.

Coalfish oil, vitamin-A content, 567.

Coccidae—

- from Malay Peninsula, 351.
- Italian, monograph, 53.
- of Australia, catalogue, 155, 559.

Coccidiosis—

- in poultry, control, 778.
- in rabbits, 778.
- in sheep, 83.

Cockerels, weight of testes as affected by feed, 271.

Cockroaches—

- German, biology and control, 53.
- popular summary, 153.

Cocks, hen-feathered, 272.

Cocoa—

- butter, detection in butter, 14.
- insects affecting, 458.
- shell meal, analyses, Can., 168.

Cocobolo, identity, 843.

Coconut—

- bleeding disease, control, 448.
- bud rot, 454.
- bud rot and cacao pod rot, comparison, 453.
- bud rot, description, 553.
- contracts, types, 786.
- holdings in Philippines, tenancy, 785.
- leaf stalk rot, 454.
- meal, feeding value, Calif., 576.
- meal protein, growth-promoting value, N.Y.Cornell, 870.
- oil, production, 636.

Coconut—Continued.

- oil refining, 109.
- palm, insect enemies, 53.
- red ring, 454.

Coconuts—

- fertilizer experiments, 40; Guam, 734.
- multiformity in, 736.
- pollination, 643.

Cod liver oil—

- and vitamins, 256.
- effect on calcium assimilation, 566.
- effect on phosphorus content of serum, 166.
- effect on rickets, 473.
- therapeutic value, 568.
- v.* butter fat, antirachitic value, 471, 472.
- vitamin A content, 567.

Codling moth—

- control, 157; Mass., 50; Mo., 350; N.J., 556.
- control in Colorado, Colo., 55.
- control in Grand Valley, U.S.D.A., 54.
- control in Washington, 52.
- in walnuts, life history, 855.
- notes, 749.
- studies, N.Mex., 352.
- trap, description, U.S.D.A., 55.

Coenzym, thermostability and differentiation from yeast vitamin, 309.

Coenzymes and vitamin B, 866.

Coffee—

- bean weevil, notes, 751.
- berry borer in Sumatra, 159.
- black rot, control, 448.
- bug, life history and control, 557.
- chicory, analyses, 416.
- culture in Colombia, 391.
- die-back in Uganda, 143.
- die-back, notes, 844.
- examination for substitutes, 416.
- leaf spot, P.R., 454.
- robusta, as food substitute, 755.
- wood, identity, 843.

Coix lacryma jobi agrestis, agronomic data, 230.

Coke and coal ashes as fertilizers, 220.

Cold storage—

- conditions for export fruit at Cape Town, 652.
- control of insects, 853.

Collargol for abortion and Malta fever, 277.

Colleges. (*See* Agricultural colleges.)

Collembola, occurrence and distribution, 752.

Colletotrichum—

- carthami* n.comb., notes, 239.
- circinans*, notes, 145.
- coffeanum*, notes, 844.
- falcatum*, notes, 45.
- gloeosporioides*, notes, 453, 653.
- lindemuthianum*, N.Y.Cornell, 648.
- unicolum*, notes, 743.
- oligochaetum*, notes, 447.
- spp., description, 239.
- spp., notes, 451, 647, 845.

Colloids—

- adsorption by, 810.
- chemistry of, treatise, 501.
- formation, monograph, 9.
- soil, origin, 809.

Colon-aerogenes group in corn meal, 356.

Color inheritance—

- in corn silk, N.Y.Cornell, 634.
- in cotton, 31.
- in Jersey cattle, Ky., 372.
- in Karakul sheep, 270.
- in phlox, 723.

(See also Pigmentation.)

Color—

- measurement, apparatus for, 111.
- production in feathers of birds, 73.
- reactions of fungi, 724.
- standards for pH measurement, 110.

Colorado College, notes, 195.

Colorimetric analysis, treatise, 709.

Colts, draft, feeding, Mo., 363.

Colts, thoroughbred, growth, 73.

Colza oil, production, 636.

Community gardens. (See Gardening.)

Community improvement. (See Rural communities.)

Community organization, 789.

Complement deviation—

- reaction for dourine diagnosis, 277.
- test for contagious pleuropneumonia, 883.

Complement fixation—

- and dourine, 774.
- rate at various temperatures, 276.
- test for tuberculosis, 482.

Compsilura spp., parasitism by, 457.

Concrete—

- abrasion test, 284.
- ball test for, U.S.D.A., 285.
- central-plant-mixed, maximum haul, U.S.D.A., 488.
- construction, treatise, 688.
- cooling, in freezing weather, 488.
- designers' manual, 85.
- disintegration in alkali soils, 85.
- effect of boiling water on, 283.
- effect of oven drying, 283.
- mixtures, excess sand in, 487.
- moisture content, effect on expansion and contraction, 888.
- molded and core, relation, 780.
- pavements, impact tests, U.S.D.A., 285.
- structures, methods of construction, 585.
- tentative specifications for, 888.
- test highway, movements in, 780.
- thermal conductivity and diffusivity, 881.

Conifers—

- gas injury to, 128.
- heart rots, 454.
- rabbit injury to, 447.
- treatment of earth about roots for Japanese beetle, 251, 252.
- winter browning, 454.

Coniothyrium—

products—Continued.

cydoniae mali n.var., 243.

hellebori, notes, 44.

Connecticut—

College, notes, 298, 699.

State Station, notes, 394, 499.

State Station, report, 697.

State Station, report of director, 598.

Stations, notes, 298, 395, 794.

Cooking recipes, 96.

Cooperation. (See Agricultural cooperation.)

Copper—

absorption by potato, 324.

acetate, conservation, 745.

arsenic dust, value, 846.

carbonate, fungicidal action, 846.

content of human brain, 861.

sulphate, effect on activity of amylases, 707.

sulphate for charlock eradication, 37.

Copperas. (See Iron sulphate.)

Copra—

exports, Guam, 734.

meal, composition, 803.

production, 636.

Corn—

amino acid content, 504.

and gluten feed, analyses, 871.

and oats, feeding value, Ill., 678.

and soy beans, hogging down, Mo., 364.

aphis, notes, Guam, 748.

as affected by borax, 123; Conn.State, 322.

bags, loading in freight cars, 586.

barium in, Colo., 29.

bollworm, control, Mo., 350.

borer, European, Guam, 748.

borer, European, in Canada, 51, 247.

borer, European, parasite of, 57.

borer, European, quarantine regulations, Ohio, 750.

borer, native, life history, Iowa, 349.

bran, analyses, Tex., 675.

breeding experiments, Guam, 726; S.C., 725.

broken ear v. shelled for steers, Ky., 367.

brown-husked type, identification of pigments, 125.

canned, bacterial flora, 859.

canned standards for, 15.

canning studies, U.S.D.A., 664.

chop, analyses, Tex., 675.

cost of production, 590; Mo., 387.

cost of production in Africa, 89.

cultivation experiments, Kans., 435; Ky., 832.

culture among Indians of Southwest, 532.

culture experiment station, 832.

culture experiments, 131, 436, 634.

culture on peat soil, 216.

disease survey in India, 544.

Corn—Continued.

diseases affecting germination, Del., 646.
 ear, black mold, control, Tex., 343.
 ear characters, Mo., 332.
 early variety in Canada, 138.
 effect on following crop, U.S.D.A., 130.
 feed meal, analyses, Mich., 168.
 fertilizer experiments, 131, 634, 817;
 Mass., 19; Mich., 518.
 germination and growth, effect of seed-
 ing date, U.S.D.A., 532.
 gluten feed, analyses, Can., 168; Mich.,
 168; N.H., 675; Tex., 675.
 gluten feed, feeding value, Iowa, 363.
 green manuring experiments, N.J., 514.
 growth in Egypt, 439.
 Guam, yields, Hawaii, 633.
 improvement by selection, 830.
 increased production, Hawaii, 633.
 industry in Antigua, 226.
 inheritance of ramose inflorescence,
 U.S.D.A., 229.
 inheritance of silk color, N.Y.Cornell,
 634.
 irrigation experiments, 634.
 leaf aphid, method of study, 245.
 leaf folder, Guam, 748.
 liming experiments, Md., 321.
 lithium in, Colo., 29.
 meal, analyses, Can., 167; Tex., 675.
 meal flora, 355.
 mosaic, studies, 344.
 new and old, nutritive value, 167.
 nutritive deficiencies, for chicks, 171.
 oil, production, 636.
 on alfalfa sod, fertilizer experiments,
 N.J., 530.
 original Iowa, 532.
 planting dates, R.I., 228.
 prehistoric and later use, 466.
 purple sheath spot, 743.
 Rhizopus infection in germinator, 846.
 root and stalk rot, N.J., 547.
 root aphid, studies, S.C., 747.
 root rot, 543; Del., 239; Kans., 448.
 root rot, acidity-infection curve, Mo.,
 344.
 root rot, studies, Iowa, 342; Ky., 846.
 roots, growth in sterile media, Mo.,
 323.
 rotation experiments, 819.
 seed, discoloration, relation to disease,
 Iowa, 342.
 seed, home-grown, value, N.J., 530.
 seed, internal fungi, 547.
 seed, selecting, 832.
 seed, yellow, vitamin A content, 357.
 seeding experiments, Guam, 726; N.H.,
 328; Tenn., 133; Tex., 328.
 seeds, mutilated, effects, U.S.D.A., 827.
 selection and breeding, Del., 628.
 shelled, respiration, Minn., 828.
 silage. (*See Silage.*)
 smut, control, 648.
 smut, notes, Kans., 448.
 (*See also Smut and Cereal smut.*)

Corn—Continued.

soy beans planted with, tests, Iowa,
 326.
 sterilization, 754.
 strontium in, Colo., 29.
 structure and function, correlation,
 Mo., 331.
 supplements for pigs, comparison, U.S.
 D.A., 767.
 sweet. (*See Sweet corn.*)
 utilization by fowls, 173.
 v. barley, feeding value, 271.
 varieties, Mich., 633.
 varieties, yields and prolificness, Miss.,
 729.
 variety tests, 131, 634; Guam, 726;
 Kans., 435; Mont., 327; N.H., 328;
 S.C., 725.
 vitamin A content, 357.
 yield, relation to weather in Argen-
 tina, U.S.D.A., 619.
 yields, Mo., 326.
 yields in New Jersey, 225.

Corncob—

and husk, ground, analyses, Tex., 675.
 sirup, fermentation, 208.

Corncocks—

acetone production from, 208.
 alcohol production from, 208.
 furfural production from, 710.
 volatile acids production from, 208.

Cornell University, notes, 197, 299, 700.

Cornstalk borer, larger, studies, Va., 155.

Corpora lutea, appearance in ovaries of
cattle and swine, 266.Corrosive sublimate and formaldehyde, com-
parison, Iowa, 342.

Corticium—

salmonicolor, distribution, 652.
salmonicolor, notes, 44.
vagum, notes, 147, 847.
vagum on sugar beets, 450.
vagum solani, notes, 847.

Coryneum foliicolum, notes, 242.*Cosmopolites sordidus*—
in Fiji, 245.

studies, 751.

Cost of production, 590; Miss., 590; N.J.,
590.Cost of production, methods of study, U.S.
D.A., 291.

(*See also specific crops.*)

Cotton—

angular leaf spot, control, S.C., 741.
 anthracnose, S.C., 741.
 as honey plant, 160.
 bacterial spot, 544.
 Belt, farm life and land tenure, 189.
 boll rot, notes, 847.
 boll weevil, dispersion, U.S.D.A., 751.
 boll weevil, studies, S.C., 747.
 boll weevil, summary, 558.
 bollworm, control, Va.Truck, 336.
 bollworm, pink, economic harm from,
 658.
 bollworm, pink, in West Indies, 56.

Cotton—Continued.

- bollworm, pink, summary, 558.
- botanical research in Egypt, summary, 230.
- breeding experiments, 226; S.C., 725.
- Bundelkhand improvement, 833.
- cake feeding value, 678.
- Conference, World, report, 729.
- cost of production, 590.
- culture along the Nile, 495.
- culture experiments, 227, 436, 437, 634.
- culture in Argentina, 635.
- culture in Brazil, 229.
- culture in French colonies, 532.
- disease, new, S.C., 741.
- disease survey in India, 544.
- diseases, notes, 845.
- duck, waterproofing, 187.
- dusting experiments, 58.
- experiment stations, Chinese, 133.
- experiments in Africa, 227.
- fertilizer experiments, 227, 437, 634; S.C., 717.
- fibers, technological qualities and classing, 635.
- five-lock bolls in, 833.
- ginneries, accounting system, U.S.D.A., 291.
- grades, manufacturing tests, U.S.D.A., 133.
- improvement by selection, 830.
- industry in Antigua, 226.
- inheritance of corolla color, 31.
- insects in South Africa, 656.
- irrigation experiments, 436, 634.
- law, Egyptian, 32.
- lime requirements, R.I., 233.
- Meade, U.S.D.A., 833.
- Pilon, description, 230.
- Pima, pollination, 31.
- planting rate, Tex., 329.
- plants, young, mineral nutrition, 629.
- production and distribution, 635.
- production, improvements, U.S.D.A., 439.
- production in British Empire, 391.
- production in China, 32.
- production in Nyasaland, handbook, 227.
- raooning experiments, 832.
- reginned and cleaned, 635.
- root aphid, life history and habits, S.C., 747.
- root rot, control, Tex., 343.
- rotation experiments, 437.
- Sea Island, fertilizer experiments, 31.
- seed and products, transactions in, rules, 32.
- seed distribution in 1921, U.S.D.A., 834.
- seed, home-grown, value, Mis., 532.
- seed in relation to community production, U.S.D.A., 229.
- (See also Cottonseed.)
- soreshin, notes, 846.
- spraying experiments, 32.
- thrips, studies, 559.

Cotton—Continued.

- time of applying potash, S.C., 725.
- varieties in Argentina, 635.
- variety tests, 227, 436, 437, 634; Guam, 726; S.C., 725; Tex., 329.
- wild, new species, 31.
- wilt in Egypt, 847.

Cottonseed—

- cake, analyses, Tex., 675.
- cold pressed, analyses, Tex., 675.
- feed, analyses, 871; Mich., 168; Tex., 675.
- meal, amino acid content, 504, 505.
- meal, analyses, 871; Mich., 168; N.H., 675; Tex., 675.
- meal and silage, feeding value, Tenn., 169.
- meal, effect on egg production, Mo., 370.
- meal, feeding value, Ind., 477; Tex., 365; Wyo., 676.
- meal injury, causes, 281.
- meal, proteins of, 505.
- mixing, U.S.D.A., 834.
- oil, production, 636.

Cottonwood for lumber production, Iowa, 341.

Cotyledons, food reserve in, 324.

Country weekly in New York State, 89.

Country. (See also Rural.)

County agent work in Northern and Western States, U.S.D.A., 94.

Cow manure, nitrification, studies, 714.

Cowpea hay, nitrifiability, 516.

Cowpeas—

- as cover crop, Guam, 726.
- as cover crop for peaches, effect, 444.
- as green manure, 320.
- improvement by selection, 830.
- liming experiments, 426.
- nitrification in South African soil, 515.
- storage experiments, 226.
- variety tests, Hawaii, 633.

Cows—

- advanced-registry tests, preliminary milking in, 879.
- body secretions in relation to milk production, Ky., 373.
- carbon dioxid capacity, 74.
- cellulose fermentation in rumen, 69, 70.
- digestion experiments, Mass., 476.
- escutcheons in relation to milk production, Ky., 373.
- feeding experiments, 678; Calif., 576; Hawaii, 679; Kans., 478; U.S.D.A., 675.
- feeding for advanced-registry test, 273.
- heavy feeding, value, Ill., 577.
- milk production. (See Milk production.)
- pasturing experiments, Kans., 478; U.S.D.A., 771.
- premature birth in, Mass., 81.
- pure bred, testing in New South Wales, 771.
- pure bred, value, Wash., 498.
- range, feeding experiments, N.Mex., 365.

Cows—Continued.

- records. (See Dairy herd records.)
- silage as hay substitute for, 372.
- (See also Calves, Cattle, and Heifers.)

Crab apples, organic acids of, 308.

Crambus—

- haytiellus* on lawns, 659.
- hortucllus*, parasites of, Mass., 52.

Cranberries—

- culture, effect of cloudiness on bog water, 632.
- fertilizer experiments, N.J., 540.

Cranberry insects, Mass., 52; N.J., 557.

Crane fly—

- biology and phylogeny, N.Y. Cornell, 57.
- life history, 460.

Crayferine, nitrifiability, 516.

Cream—

- chemistry of, 275.
- pasteurization, 174.
- testing, Calif., 578.

Creameries, cooperative, methods of control 772.

Creamery, Grove City, 879.

Creatin, arginin and cystin as precursors, 65.

Creatin in muscle extracts, 564.

Creatinin in muscle extracts, 564.

Creatinuria—

- of man, diet, and sex as factors, 757.
- studies, 65.

Crepis—

- capillaris*, inbreeding and crossbreeding in, 223.
- spp., interspecific hybrids in, 223, 721.

Cresol, determination, 14.

Cresols and substances for cresol soaps, 374

Cress seedlings, growth in wind, 827.

Cricket—

- black horned tree, notes, 50.
- repellents, 657.

Crickets, sarcophagid parasite of, 458.

Cronartium ribicola. (See White pine blister rust.)

Crop—

- development and production studies, 28.
- production, manure v. fertilizers, 623.
- production, treatise, 29.
- Protection Institute, fellowships, 599.
- reports, U.S.D.A., 193, 293, 596, 789.
- rotations. (See Rotation of crops.)

Crops—

- and tillage, textbook, 696.
- as affected by sulphur, 428.
- in Wisconsin, cost of production, 389.
- quality, relation to soil fertility, 623.
- self-fertilized, genetic basis for improvement, 437.
- time to sell, Mich., 598.
- (See also Field crops, and specific crops.)

Crown gall on rubber tree, behavior, 49.

Crude fiber. (See Cellulose.)

Cryptocleptes n. g., description, Miss., 461.

Cryptococci in digestive tube of lymphangitic horse, 83.

Cryptomeria japonica, darkening of heartwood, 644.

Cryptotermes brevis, notes, 559.

Crystopus bliti on sugar beets, 450.

Cubeb substitutes, 755.

Cucumber—

- beetles, parasite of, 461.
- beetles, western, control, 856.
- fruit spot, 449.
- gummosis, 544.
- leaf spot, 447.
- Sclerotium disease, 543.
- seed, relation of age to productivity, 640.
- wilt, 447.

Cucumbers, forcing with neon light, 640.

Cucurbit diseases, Del., 646.

Culex—

- aegypti*, notes, 661.
- quinquefasciatus*, notes, P.R., 157.

Cultivators, motor, in Europe, 890.

Culture media—

- acidity, determination by Fuller's scale, 724.
- buffer index, pH and titration determinations, 708.
- change in pH during heating, 413.
- sterile, device for growing large plants in, 124.
- titration, Mich., 413.
- use in characterizing Actinomycetes, N.Y. State, 317.
- with wide pH range, N.C., 740.

Cupressus seedlings, dying-off disease, 544.

"Cupu" seeds, analyses, 108.

Curly dwarf, Can., 145.

Currant—

- anthracnose, control, 844.
- aphis, red, production of winged forms, 154.
- diseases, 243, 646.
- rust, notes, 844.
- shoots, hardness, relation to pentosan content, 443.
- sunburn, notes, 447.

Currants—

- black, detecting reversion, 39.
- breeding experiments, 39.
- insects affecting, 243.
- storage studies, 338.

Cuscuta epilinum on flax, 743.

Cuscuta, parasitism by, 343.

Cuterebra larvae from cats, 686.

Cutin and suberin in plants, 631.

Cut-over lands in Michigan, classification, 42.

Cutworm—

- army, control, 153.
- pale western, control, 153.
- pale western, parasites of, 247.
- pale western, summary, 352.
- variegated, life history, 660.

Cutworms on rice, 458.

Cyanamid in fertilizers, 717.

Cyanid for gopher control, 455.

(See also Hydrocyanic acid.)

Cylas formicarius. (See Sweet potato weevil.)

Cyllene—

caryae, summary, N.Y.Cornell, 249.

robiniae, relation to *Solidago* species, Ky., 57.

picta. (See Hickory borer.)

Cymatophora sulphurea on cranberry, Mass. 52.

Cynipidae, parasitic, descriptions of genotypes, 58.

Cystin, effect on starch hydrolysis, 708.

Cytology, treatise, 823.

Cytospora—

batata, notes, 551.

chrysosperma in Northwest, 850.

Daffodil, new, production in marine climate, 720.

Dahlias, variety tests, 839.

Dairy—

buildings, relation to sanitation, 174.

chemistry, treatise, 113.

Congress, World's, 400.

cows. (See Cows.)

farm inspection, 174.

farm survey in British Columbia, 90, 679.

farming, effect of milk recording societies, 679.

feeds, analyses, Mich., 168.

herd records, 878.

herds, testing, 771.

houses, plans and construction, U.S. D.A., 288.

laboratory exercises, 295.

plants, milk control in, 75.

products, biological changes in, determination, Mich., 479.

products, examination, methods, 113.

products, lime determination in, 680, 710.

sires. (See Bulls and Sires.)

statistics, availability and usefulness, 177.

Dairying—

cooperative, in Missouri, 292.

in China, 573.

in New Hampshire, 273.

treatise, 73.

(See also Creameries, Milk, etc.)

Dams and levees, hydraulic fill, 779.

Dates, insects affecting, 558.

Dates, propagation from seeds, 235.

Daturas, inheritance in, 430.

Deficiency diseases. (See Diet.)

Dehydraters, types in California, Calif., 509.

Dehydration. (See Drying.)

Delaware Station—

notes, 195.

report of director, 698.

Delphax saccharivora, notes, 558.

Dematium pullulans, notes, 554.

Dendrograph, study and use, 24.

Denmark, a cooperative commonwealth, treatise, 292.

Department of Agriculture. (See United States Department of Agriculture.)

Deraeocapsus, new genus, erection, Minn., 854.

Deraeocoris, North American species, keys, Minn., 854.

Dermacentor venustus, control, 59, 555.

Desert—

plants, transpiration changes in, 26.

valley, vegetation, 26.

watering places in California, routes to, 380.

Desmocerus spp., notes, 856.

Dewberry-raspberry hybrid, Tex., 335.

Dextrin, determination, 506.

Dextrose, determination, table for, 506.

Diabetic diets, vegetables in, 570.

Diabrotica spp., parasite of, 461.

Diagnostic methods, treatise, 880.

Diallel crossings with trout, analysis of results, 268.

Diaperomera femorata. (See Walking-stick.)

Diaprepes abbreviatus on sugar cane, 534.

Diarrhea—

bacillary white, control, N.J., 584.

bacillary white, of fowls, Mich., 584.

white, in calves, 582.

Diatraea zeacolella, studies, Va., 155.

Dichlorocresol, effect on plants, 544.

Dictyocaulus filaria eggs, studies, 59.

Dictyophora phalloidea, notes, 45.

Dicyandiamid, effect on plant growth, 625.

Dicyclus fuscicornis, parasitism by, 158.

Dicymolomia julianalis, studies, N.Y.Cornell, 465.

Diet—

accessory factors. (See Vitamins.)

choice by rats and mice, 758.

deficient, cause of sterility, 261.

deficiency disease, 359, 869.

deficiency disease, deficit in animal tissues, 761.

deficiency diseases in Labrador, 63.

(See also Beriberi, Pellagra, Polyneuritis, Rickets, and Scurvy.)

effect on intestinal flora, 666.

in university boarding halls, 562.

minerals in, importance, 259.

of Australians, 563.

of children. (See Children.)

of infants. (See Infants.)

relation to climatic conditions, 561.

role in creatinuria of man, 757.

vitamin-rich, effect on backward children, 868.

(See also Food and Nutrition.)

Dietary in Kansas institutions, 468.

Dietetics—

and public health, 862.

teaching to student nurses, 697.

Dietitians—

in Illinois institutions, duties, 260.

professional training, 696, 697.

Diffusion rate, effect on concentration of electrolyte, 126.

Diplococcus sp., notes, 777.

Diplodia—

cacaoticola, notes, 647.

zeae on corn, 547; Del., 239.

Diptera—

anatomical studies, N.Y.Cornell, 459.

new species, 57.

Dipterocarps, Philippine, fiber studies, 445.

Diseases—

deficiency. (See Diet deficiency diseases.)

of animals. (See Animal diseases, and specific diseases.)

of plants. (See Plant diseases, and specific host plants.)

Dishes as carriers of tubercle bacilli, 361.

Disinfectants, bactericidal properties, testing, 374.

Disinfection and sterilization, treatise, 310.

Distillation—

apparatus, 111.

fractional, receiver for, 414.

of waste western yellow pine, U.S.D.A., 312.

Distillers' dried grains, analyses, Mich., 168.

Distol, anthelmintic value, 684.

Ditch design and prevention of silt deposit, 778.

Ditches, drainage and irrigation. (See Drainage and Irrigation.)

Djali bras, agronomic data, 230.

Dociostaurus maroccanus, notes, 851.

Dock, curly, as host of leafhopper, Iowa, 349

Dodder gall weevil, notes, 661.

Dog anatomy and physiology, atlas, 778.

Dogs—

diseases of, treatise, 276.

feeding experiments, 68.

hookworms in, treatment, 686.

Domestic science. (See Home economics.)

Doryctes radiatus, parasitism by, 250.

Doughnuts of low fat absorption, making, 259.

Douglas fir—

aphis in England, 53.

in semiarid regions, distribution, 445.

of British Columbia, 236.

Phomopsis pseudotsugae on, 244.

strength, effect of moisture, 779.

Dourine—

and complement fixation, 774.

diagnosis, 277, 774.

in Canada, 485.

Doves, physiology of reproduction, 267.

Drain gauges, Craibstone, 811.

Drainage—

districts, financing, 98.

in relation to malaria control, 460.

laws of Minnesota, 487.

measurement, 811.

papers on, 381.

pump, of marsh land, Wis., 185.

subgrade, tests, U.S.D.A., 187.

Drain tile—

flow of water in, 778.

for acid peat, Wis., 186.

Drain tile—Continued.

standards, 285.

testing, standard methods, 283.

Dressmaking, paper dress form for, U.S.

D.A., 792.

Dried blood—

availability as affected by soil, N.J., 519.

effect on availability of rock phosphate.

Ohio, 429.

effect on soil reaction, 211.

nitrifiability, 516.

Drosophila melanogaster—

duration of life, 661.

eggs as affected by X-rays, 673.

Drought—

of 1921 at Kew, 712.

periods and climatic cycles, 209.

Drug and aromatic plant production, 41.

Drugs—

crude, drying, U.S.D.A., 208.

examination under pure food law, 60.

Dry farming—

experiments, U.S.D.A., 724.

experiments in Africa, 227.

experiments in Egypt, 816.

tillage experiments, Wash., 216.

Drying, symposium on, 11.

Ducks—

digestion and nitrogen-balance trials, 173.

respiration calorimeter experiments, 172.

Duhat, vitamin content, 667.

Durra disease survey in India, 544.

Dust, copper-arsenic, value, 846.

Dust insecticides in California, 852.

Dusting—

for fruit diseases and pests, 448.

machine, experiments, 854.

v. spraying, 52, 845.

(See also Spraying and specific plants.)

Dyes, tests of plants for, 227.

Dynamometers—

for tractors, 491.

hydraulic and spring, 585.

rotation, description, 890.

Dysentery—

bacilli, viability in excrement, 588.

chronic bacterial. (See John's disease.)

Ear tick, spinose, suppression, 661.

Echinococcosis, serum diagnosis, 276.

Echinodontium tinctorium on blazed trees, 151.

Ecology—

of Big Stone and Lake Traverse region, 222.

of Santa Lucia Mountains, 26.

of strand vegetation, 27.

Economic conditions in Philippines, treatise, 895.

Economics, rural. (See Rural economics.)

Economy, national, principles, treatise, 590.

Eddoes, variety tests, 226.

Education, agricultural. (See Agricultural education.)

- Education, vocational. (*See* Vocational education.)
- Egg—
 powder, composition, 204.
 production—
 as affected by artificial light, 678, 875; N.J., 574; N.Mex., 370.
 as affected by feed, 770; Iowa, 363; Mo., 370.
 costs, N.J., 574.
 genetics of, 876.
 predicting, 575.
 relation to keel bone, 770.
 value of animal protein for, Ky., 875.
 (*See also* Hens, laying.)
 protein in human milk, 564.
 shells, thin, causes, 267.
 yolk formation, 173.
- Egg-laying—
 contest, Wash., 478.
 contest in Ireland, 73.
 contest in New South Wales, 273.
 contest, value to poultry industry, 770.
 contests, N.J., 877.
- Eggplant—
 disease, Mass., 43.
 sun-dried, vitamin content, 359.
 wilt, notes, 43, 844.
- Eggplants, hardening process in, Mo., 827.
- Eggs—
 air cell in, measurements, N.J., 574.
 candling, Mont., 273.
 composition, effect of calcium, 876.
 dried, bacteriological analyses, Mich., 466.
 establishing type and size, 876.
 hatchability and chick mortality, 769.
 in incubators, turning experiments, N.J., 574.
 incubation period, variation in, Guam, 764.
 premature, method of obtaining, 769.
 preservation, 877.
 producing, handling, and packing, N.J., 273.
 vitamin content relation to feed, Kans., 478.
- Eimeria pfeifferi* in pigeons, 886.
- Electric motors, fees and tests, 491.
- Electricity, effect on plant growth, Ky., 830.
- Electrolytes, concentration, effect on diffusion rate of water, 126.
- Elevators, pneumatic, theory and practice, 689.
- Elm destruction by poison gases, 829.
- Embaphion muricatum*, biology, 354.
- Empoasca mali*. (*See* Apple leafhopper.)
- Empusa muscae*, overwintering, 51.
- Encelia farinosa*, seasonal changes in transpiration, 26.
- Encephalitis lethargica and botulism, differential diagnosis, 262.
- Endocarditis, relation to blackleg, 481.
- Endocrine glands, effect on body development, 72.
- Endomyces vernalis*, digestibility and use, 68.
- Energy—
 expenditure of laborers, 571, 572.
 metabolism, law of surface area in, 755.
- Engineering—
 agricultural. (*See* Agricultural engineering.)
 construction, cost keeping and management, 888.
 cost accounting, treatise, 486.
 materials, physical properties, 688.
 rural, applied to colonies, 886.
 structural drafting and design, 888.
- Engines—
 internal combustion, for farm light and power plant, 891.
 internal-combustion, laboratory manual, 890.
 tractor. (*See* Tractor engines.)
- Enteritis, chronic. (*See* Johne's disease.)
- Enterohepatitis, infectious. (*See* Blackhead.)
- Entomological investigation, methods, 51.
- Entomology. (*See* Insects.)
- Entomophthoraceae, insect enemies, 51.
- Entomosporium maculatum*, notes, 543.
- Entyloma ranunculi*, notes, 44.
- Enzymes—
 activities in duodenum, estimating, 708.
 chemistry of, 9.
 reactions in peach, Del., 628.
- Epelis truncataria fawonii* on cranberry, Mass., 52.
- Ephydra subopaca*, biology, N.Y. Cornell, 751.
- Epicauta* spp., notes, U.S.D.A., 158.
- Epinephrin for purpura hemorrhagica, 686.
- Epiphytes, distribution on tree trunks in Java, 720.
- Epitheliosis, contagious, N.J., 583.
- Ergot, studies, 546.
 (*See also specific host plants.*)
- Erinecosinus n.g., description, Miss., 461.
- Erysiphe*—
 communis, notes, 451.
 graminis, notes, 239.
 polygoni, notes, 845.
- Essential oils. (*See* Oils, essential.)
- Ethmia macelthosiella*, life history, 856.
- Ethyl and methyl alcohol, determination, 505.
- Eubrachymera debilis*, notes, 59.
- Eucalyptus—
 injury from high temperatures, 446.
 new species, descriptions, 737.
- Eulia velutinana*, notes, 749.
- Euproctis chrysorrhoea*. (*See* Brown-tail moth.)
- Eutettix tenella*. (*See* Beet leafhopper.)
- Euthrips helianthi*, notes, 853.
- Euthyrhinus mediatundus*, life history, 254.
- Evaporation observations, U.S.D.A., 618.

Evolution—

- and mutations, 524.
- of plants, 524.
- studies, 573.

Ewes, breeding—

- feeding experiments, Mont., 364.
- wintering, 72.

Ewes, production of twins, factors affecting, U.S.D.A., 170.

(See also Sheep.)

Exanthema, coital, and horse pox, 778.

Excavating machinery, 381.

Ewoascus deformans, notes, 348, 453, 544.

Experiment Station—

- at Cuba, 96.
- for corn culture in Italy, 832.
- of Yonne, 294.
- Record, notes, 199.

Experiment stations—

- home economics at, editorial, 601.
- list of projects, U.S.D.A., 297.
- publications and projects, 404.
- specialization and correlation of work, 105.
- work and expenditures, U.S.D.A., 598.
- work, duplication in, 401.
- (See also Alabama, Arizona, etc.)

Explosives—

- nitrogenous, potassic fertilizers from, 626.
- use in blasting stumps, U.S.D.A., 85.

Export packing, treatise, 383.

Extension work. (See Agricultural extension.)

Fallowing experiments, Mont., 830; U.S. D.A., 130.

Family—

- budget systems, 96.
- life on moderate income, treatise, 792.

Fannia canicularis, biology of, 51.

Farcy. (See Glanders.)

Farm—

- accounting, cooperation in, 493.
- accounting, institutions for, 591.
- animals, feeding, treatise, 70.
- (See also Live stock and Animals.)
- buildings, developments in, 99.
- bureau movement, treatise, 386.
- business in Quebec, Can., 893.
- community in New York, national influence of, U.S.D.A., 386.
- credit. (See Agricultural credit.)
- development studies, Minn., 493.
- economics, research, 783.
- economics, State program, 783.
- equipment costs, Mo., 387.
- forestry, 42.
- homes, survey, 695.
- implements, draft and operation cost, Mo., 385.
- labor. (See Agricultural labor.)
- land, gift to British Government, 398.
- life in Cotton Belt, 189.
- loan association, national, directions for forming, 90.
- loans, short-time, U.S.D.A., 786.

Farm—Continued.

- machinery. (See Agricultural machinery.)
- management, 389.
- management, normal institute in Belgium, 194.
- management, research, 783.
- management, State programs, 389, 783.
- management, studies, N.J., 590.
- management, textbook, 693.
- mortgage loans, U.S.D.A., 786.
- organization and practice, changes in, 892.
- organization, methods of study, U.S. D.A., 291.
- ownership in United States, 893.
- power and lighting, handbook, 891.
- power, cost and utilization, U.S.D.A., 383.
- products. (See Agricultural products.)
- sanitation, 99.
- tenancy in 1920, 893.
- (See also Land tenancy and Land tenure.)
- timber, measuring and marketing, U.S.D.A., 237.

Farmers—

- financing, 192.
- place in the commonwealth, 91.

Farmers—

- library, book list for, Ill., 697.
- problems, 387.
- purchasing power, 90.
- winter school, Wash., 297.

Farming—

- costs, determination, treatise, 493.
- dairy. (See Dairy farming.)
- in Corn Belt, 784.
- textbook, 696.
- (See also Agriculture.)

Farms—

- and ranches, Government, homesteading, 91.
- animal power on, 99.
- purchasing, initial payment required, 388.

Fat—

- chemistry, progress, 613.
- excess, effect on growth of tadpoles, 565.
- in diet, dispensibility, 565.
- necrosis in cattle, 683.
- transport in animal body, 861.

Fat-free diets, metabolism experiments, 255.

Fatigue, chemical factors in, 475.

Fats—

- animal, factors affecting composition, Kans., 476.
- animal, international trade, 675.
- chemotherapeutic studies, 579.
- digestibility, 758.
- extraction from leather, 114.
- factors affecting composition, Kans., 476.
- iodin number, determination, 709.

Fats—Continued.

- melting point determination, 13.
- nutritive value in relation to vitamin A content, 256.
- shortening value, 258.
- vitamin A content, relation to yellow pigments, 61.

(See also Oils.)

Fat-soluble A. (See Vitamin A.)**Fatty acids, melting point determination, 13.****Fauna of British India, treatise, 461.****Feathers, causes of whiteness in, 264.****Feces—**

- calcium determination in, 417.
- floral content, of infants, 571.
- magnesium determination in, 417.
- potassium determination in, 417.
- sodium determination in, 417.

Federal farm loan system, treatise, 388.**Feed mixtures, quantitative analysis, 71.****Feeding—**

- and calculation of rations, principles, 696.
- experiments, financial phases, Ill., 365.
- (See also Cows, Pigs, etc.)
- science of nutrition as guide, 871.

Feeding stuffs—

- amino acids in, 504.
- analyses, Can., 167; Mich., 168; Tex., 675.
- analyses in Florida, 871.
- composition and classification, 70.
- inspection, Vt., 572.
- inspection and analyses, Ky., 572; Me., 572; N.H., 674.
- money value, calculation, 70.
- selection, 70.
- with cellulose evaluation and digestibility, 68.

Fen soils, claying, 216.**Fence posts, treatment, 383; Iowa, 383.****Fences, farm, construction, 491.****Ferments. (See Enzymes.)****Fern—**

- leaf scorch, 647.
- weevil, notes, 58.

Ferrous oxid, effect on wheat, 717.**Ferrous sulphate treatment of soil, 812.**

(See also Iron.)

Fertilizer—

- experiments, 818; N.H., 318; U.S.D.A., 130.
- experiments on grasslands and pastures, 131.
- (See also special crops.)
- industry, effect of railway rates, 522.
- industry, relation to experiment stations, 522.
- laws of Georgia, 522.
- requirements of soils. (See Soils.)
- spreaders, lime nitrogen, tests, 188.

Fertilizers—

- analyses in Georgia, 522.
- cyanamid in, 717.
- effect on composition of cherries, 736.
- efficiency of, R.I., 217.

Fertilizers—Continued.

- functions and uses, 19.
- higher analysis formulas, 522.
- inspection and analyses, Conn.State, 522; Ky., 322; R.I., 221; S.C., 124; Tex., 124; Vt., 522.
- inspection and analyses in Florida, 430.
- inspection and analyses in Porto Rico, 823.
- law of physiological relation in, 318.
- manufacture, treatise, 518.
- manufacturers, directories, 430.
- new, 124.
- nitrogenous. (See Nitrogenous fertilizers.)
- organic, production of carbon dioxide in soils by, 321.
- phosphatic. (See Phosphates.)
- physiological values in, 318.
- potash. (See Potash.)
- registered brands, 24.
- use, 424.
- use in South Australia, 20.
- v. manure for crops, 623.
- yearbook, 430.

Feterita, yields, Mo., 326.**Fiber—**

- crude. (See Cellulose.)
- plants of Sweden, 532.
- plants, tests, 227.

Fibers—

- animal, used in textiles, 770.
- determination of flexibility, 230.
- of Philippine dipterocarps, 445.
- (See also Hemp.)

Field crops—

- cooperative experiments in Ontario, 226.
- labor and material requirements, U.S.D.A., 493.
- nomenclature of varieties, 129.
- work—
 - at Reading, 131.
 - in Antigua, 226.
 - in British Guiana, 727.
 - in Denmark, 436.
 - in England, 726.
 - in India, 131, 227, 436, 531, 634, 727, 831.
 - in Mesopotamia, 436.
 - in Montserrat, 131.
 - in Nigeria, 437.
 - in Scotland, 227.
 - in Uganda, 634.
 - in Union of South Africa, 227.
 - in West Indies, 226.

(See also Crops, Forage crops, Root crops, etc.)

Field experiments, standardization, 829.**Fig—**

- branch disease, studies, 48.
- insects, studies, 52.

Figs—

- liparid moth affecting, 559.
- Smyrna, culture in America, 444.
- studies in India, 640.

Filberts, pollination, 340.

Filter paper, effect on permanganate-oxalate titrations, 805.

Filters—

membrane, for chemical analyses, 614.
sand, adsorption in, 892.

Filtration symposium, papers, 613.

Fir trees, spacing experiments, 236.

Fire—

blight, bacteriological history, 451.
blight distributors, 348.
cause of mutation in plants, 27.

Fireplaces, construction, U.S.D.A., 386.

Fires, forest. (*See* Forest fires.)

Firewood. (*See* Wood, fuel.)

Fish—

brine freezing, 466.
canning, 664.
canning in England, methods, 466.
control, 460.
cultures, fundamentals, treatise, 720.
culture on the farm, 73.
liver oils, vitamin A in, 567.
meal, feeding value, 873.
Pacific Coast, chemical study, 466.
preservation in chilled brine, 664.
viviparous, inheritance in, 268.
zinc distribution in, 566.
(*See also specific kinds.*)

Flag smut, control, 448.

Flax—

breeding experiments, 633.
Colletotrichum on, 239.
culture experiments, 131; U.S.D.A., 724.
culture on peat soil, 216.
curing and retting in France, 533.
determination of flexibility, 230.
diseases, studies, 743.
flea-beetle, notes, 743.
grading, 533.
pollen, studies, 32.
production in Ireland, 834.
retting in Canada, 230.
seeding dates, 531.
variety tests, 436.
yields, Mont., 327.

Flaxseed oil, production, 636.

Flies—

house. (*See* House fly.)
muscoid, synopsis of puparia, 661.
white. (*See* White fly.)

Flood control in agriculture, 98.

Floors and floor coverings, U.S.D.A., 89.

Flora—

of British Guiana, 222.
of Jamaica, 222.
of Oregon coast, 222.
(*See also* Vegetation.)

Florida University and Station, notes, 298.

Flour—

baking strength, Can., 162.
buffer action of water extracts, 612.
durum, baking tests, 536.
foreign starches in, detection, 807.
grades, studies, 612.
milling and bread-baking qualities
Ohio, 665.

Flour—Continued.

milling, effect of weather, 860.
moisture content, factors affecting,
U.S.D.A., 665.
moisture content, variation, 561.
prepared, vitamins in, 469.
red dog, analyses, Can., 167; N.H.,
675; Tex., 675.
testing mill, State, in Minnesota, 499.
(*See also* Bread.)

Flowers, culture, treatise, 138.

Fluorspar, effect on phosphatic slag, 22.

Fodder crops. (*See* Forage crops.)

Fomes—

lignosus, host plants, 455.
officinalis, summary, 348.
spp. on blazed trees, 151.

Food—

and nutrition projects at experiment
stations, 602.
and nutrition, relation to climatic con-
ditions, 561.
bottled, volume variations, U.S.D.A.,
468.
chemistry and human nutrition, 355.
chemistry, treatise, 560.
conservation movement, value, 562.
consumption in Kansas institutions,
468.
crops, yields in Ireland, 391.
distribution, reforms in, 694.
energy value, determination, 755.
for an average family, guide, U.S.D.A.,
498, 666.
infections, symptoms and cause, 571.
ingestion, effect on purin metabolism,
757.
manufacture, relation to nutrition, 256.
materials, strictly exogenous, 259.
preparation in prehistoric times, 467.
preservation, studies at experiment sta-
tions, 608.
products inspection law, regulations,
U.S.D.A., 291.
products, source, chemistry, and use,
treatise, 859.
putrid, toxicity, 753.
Research Institute of Stanford Univer-
sity, 798.
substitutes, 755.
substitutes and control in Germany,
666.
supply in United States, 590.
values, U.S.D.A., 465.
(*See also* Diet.)

Foods—

analyses and energy values, treatise,
161.
canned. (*See* Canned foods.)
cooked in pressure cooker, effect, 257.
drying. (*See* Drying.)
examination under pure food law, Me.,
60.
teaching in rural schools, 792.
tryptophan content, 758.
vegetable and fish, in Madeira, 859.

Foods—Continued.

vitamins in, 864; Ark., 667.

(*See also specific foods.*)

with specific action, 470.

Foot-and-mouth disease—

immunity from milk of cured animals, 376.

immunization, 375.

notes, 277, 773.

occurrence in Great Britain, 178.

sera, standardization, 774.

serum production in, 881.

studies, 579.

treatment, 881.

Forage and grain, amount for work animals, Ill., 678.**Forage crops—**

culture, Mass., 30.

culture experiments, 131, 227, 634.

diseases, Kans., 448.

fertilizer experiments, 227, 634.

in Wales, 727.

increase in Denmark, treatise, 227.

irrigation experiments, 634.

variety tests, 131, 227, 634.

Forage poisoning. (*See* Live stock poisoning.)**Forest—**

administration. (*See* Forestry.)

botany, treatise, 221.

College, Imperial, report, 791.

cover, effect on stream flow, 738.

experiment stations, U.S.D.A., 41.

fire protection, cooperative, in Georgia, 645.

fire protection in Minnesota, 237.

Harvard, management, 842.

insects, notes, 558.

insects of Pacific slope, 852.

land valuation, manual, 693.

laws, French, handbook, 141.

mensuration, handbook, 444, 693, 739.

mensuration, textbook, 341.

planting methods, relation to frost injury, 236.

planting on the farm, 42.

rangers, Spanish terms for, U.S.D.A., 341.

reproduction in Michigan, 645.

resources of Finland, 237.

resources of Southern States, 541.

roads, notes, U.S.D.A., 489.

seeds, effect of origin, 41.

survey, papers on, 141.

trees. (*See* Trees.)

types of United States, 444.

Forestation and drought, 42.**Forestry—**

education in, 896.

Experiment Station, Southern, 398.

in Australia, 541.

in Baluchistan, 238.

in Canada, 141.

in China, 141.

in Dutch East Indies, 41.

in Great Britain, 541.

Forestry—Continued.

in India, 238, 541, 645.

in Indiana, 237.

in New South Wales, 843.

in New York, 843.

in Norway, 898.

in Ontario, 41.

in Oregon, 340.

in Philippines, 645.

in Queensland, 340.

in Switzerland, 237.

in Tasmania, 739.

in Union of South Africa, 541.

in United States, status, 340.

in Utah, U.S.D.A., 341.

research in Canada, 739.

School, Yale, notes, 399.

textbook, 236.

Forests—

effect on stream flow, 141.

health, of Finland, regeneration, 738.

injury from gas and smoke, 738.

National, U.S.D.A., 542.

National, in California, campers' handbook, U.S.D.A., 341.

of Italian lake region, 42.

of Maryland, 842.

of Sweden, insects affecting, 51.

thinning experiments, 237.

upland and bottomland, soil temperatures, 211.

windfall injuries, 644.

Formaldehyde—

analysis, 114.

and corrosive sublimate, comparison, Iowa, 342.

as nutrition for algae, 824.

effect on activity of amylases, 707.

effect on plants, 544.

for seed potato treatment, 650.

hot, for potato scab, 549.

in conserved liquid manure, effect on plants, 518.

treated wheat, effect on germination, 241.

Fowl—

cholera, serum treatment for, 196.

pest in Argentina, 184.

scab, unusual form, 885.

typhoid, serum treatment for, 196.

typhoid, vaccine for, Kans., 485.

Fowls—

anthelmintics for, 687.

diseases of head, diagnosis, 778.

tuberculin and eyelid test, 280.

(*See also* Chickens, Hens, Poultry, etc.)

Foxes—

hookworm remedies for, 184, 185.

parasites of, 686, 886.

ranch, food requirements, 770.

Fox-farming industry, problems, 770.

Frear, W., biographical sketch, 197.

Frit fly, habits, 158.

Frit fly in winter wheat, 460.

Froghoppers, grass-feeding, life cycle, Conn. State, 154.

Frost, effect on keeping quality of potatoes, 135.

Frost warnings, physical laws as basis, 208.

Fructose, determination, 506.

Fruit—

breeding activities, 839.

bud formation, 38.

bud formation, localization of factors, Mo., 337.

butters, manufacture, 755.

diseases following neglect after freeze, Ohio, 348.

fed cows' milk, cheese from, 276.

growing, cooperative, in Massachusetts, 695.

growing in British Isles, 233.

juice beverages, imitation, manufacture, 113.

juice powder, apparatus for making, 11.

juices, clarification, U.S.D.A., 616.

juices, concentrated, antiscorbutic value, 261.

moth, oriental. (*See* Peach moth, oriental.)

tree leaf roller, oil sprays for, 855.

tree leaf roller, summary, 156.

tree silver leaf disease, 451.

trees, alternate bearing, 735.

trees, brown bark spot, notes, Mont., 343.

trees, root development, 38.

trees, top grafting, Wash., 498.

trees, transplanting, 839.

trees, winter injury, 139.

trees, winter study, 239.

Fruits—

breeding experiments, 39.

canning, U.S.D.A., 208.

citrus. (*See* Citrus fruits.)

crystallized, summary, 755.

culture and marketing, 840.

culture in Canada, 234.

culture in Syria and Cilicia, 339.

depth of planting studies, Del., 640.

dried, energy value, 859.

export, cold-storage conditions at Cape Town, 652.

freeze injury in 1921, 233.

growing in California, 139.

home storage, 386.

indigenous to Philippines, value, 339.

insects affecting, in Germany, 458.

insects and pests, control, 656.

preservation, 840.

preservation, studies at experiment stations, 609.

propagated at Ottawa, list, 443.

small, planting and care, U.S.D.A., 537.

small, production in United States, 642.

small, variety tests, Del., 639.

stone, diseases, 453.

storage in winter, Wash., 233.

tropical, preservation, 114.

(*See also* Orchards, Apples, Peaches, etc.)

Fuckelia botryoidea n. sp., description, 243.

Fumigation—

greenhouse, notes, 641.

situation in California, 52.

Fungi—

and galls in Poland, 742.

attacking paints, N.J., 554.

cause of deterioration of sugar, 206, 417, 418.

control, 336.

entomogenous, 51.

from spotted apples, diagnosis, 242.

insect-destroying, 51.

new color reactions for, 724.

on economic plants in Indo-China, 741.

parasitic, perennial mycelium, 545.

physiology of, studies, 324.

Fungicides—

analyses, Conn.State, 522.

comparison, 448.

composition and use, Mass., 38.

inspection and analyses, Mich., 444.

toxic action to parasitic fungi, N.H., 343.

(*See also* Sprays and specific forms.)

Fungus diseases for combating insect pests, 457.

Fur trade and supply, 655.

Fur-bearing animals—

laws, U.S.D.A., 151.

trapping, 455.

Furfural production from corneobs, 710.

Fusarium—

conglutinans, notes, 543, 551; Va., 648.

culmorum, notes, 239.

liri, food relations, 224.

mini, notes, 242.

moniliforme on corn, 547; Del., 239.

moniliforme, studies, Ky., 846.

sp. in corn meal, 356.

spp., notes, 145, 451, 544, 847.

Fusicladium—

amygdali, control, 850.

dendriticum. (*See* Apple scab.)

erobotryae, notes, 44.

Galactose, preparation, 10, 308.

Gambusia affinis, studies, 157.

Game—

laws for 1921, U.S.D.A., 151.

laws in Massachusetts, 694.

protection, directory of officials for, U.S.D.A., 151.

Ganoderma sp., notes, 348.

Garbage feeding relation to hog cholera, 874.

Garden—

crops. (*See* Vegetables and specific crops.)

insects, summary, 153.

Gardening—

in Oregon, Oreg., 838.

instructions, U.S.D.A., 537.

landscape, treatise, 236.

lessons in, 898.

principles, treatise, 838.

Garget. (*See* Mammitis.)

- Gas—
 meter, laboratory, description, 201.
 plant waste water, fertilizing value, 220.
 plants and engines, suction, 585.
- Gases, poisonous—
 effect on elm, 829.
 injury to vegetation, 128, 738.
- Gasoline—
 State taxation, U.S.D.A., 86.
 treatise, 87.
- Gasoline-kerosene mixtures, flash and burning points, 490.
- Gastric analysis—
 equilibrium zone, 666.
 Rehfuß fractional method, 710.
- Gastrophilus*—
equi. (See Bots.)
intestinalis as affected by thymol, 885.
 spp., treatment for, 686.
- Geese—
 digestion and nitrogen-balance trials, 173.
 respiration calorimeter experiments, 172.
- Gelatin detection in meat extract, 13.
- Gelechia gossypiella*. (See Cotton boll-worm, pink.)
- Genetics. (See Heredity and Hybridization.)
- Geography—
 commercial, textbook, 895.
 economic, treatise, 295.
 political, new world problems in, 697.
- Geotropism, theory, 527, 528.
- Geranomyia canadensis*, life history, 460.
- Geum root rot, 544.
- Ghee making in India, 276.
- Gibberella saubinetii*—
 on corn, 547; Del., 239.
 popular account, U.S.D.A., 240.
 tolerance for H-ion concentration, Mo., 343.
- Gipsy moth parasites, distribution, 457.
- Girls' clubs—
 in Kansas, 194.
 in New Zealand, 793.
 notes, Guam, 793.
 relation to rural homes, 598.
 status and results, U.S.D.A., 393.
- Glands—
 control in Massachusetts, 681.
 immunization, 485.
 lid test, value, 278.
 notes, 773.
 occurrence in Great Britain, 178.
 summary, 580.
- Gleditsia, thick-walled root hairs, 631.
- Globulin in maple seed, N.Y.State, 308.
- Gloeodes, new genus, erection, 552.
- Gloeodes pomigena* n. comb., 552.
- Gloeosporium*—
ampelophagum, control, 543.
carthami, n. comb., notes, 239.
coffeanum, notes, 647.
laeticolor, varietal resistance of peach to, 243.
- Gloeosporium*—Continued.
musarum, on banana, 845.
 n.spp., description, 239.
papayae, notes, 454.
 spp., notes, 451.
tremellinum n.sp., description, 829.
venetum, notes, 143.
- Gloeosporiums, Japanese, morphology and physiology, 239.
- Glomerella*—
cingulata, studies, 148.
rufomaculans, notes, 451.
 spp., notes, 845.
- Glove making around Oxford, 788.
- Glycerophosphoric acid, ionization constants, 413.
- Glycin, effect on starch hydrolysis, 707.
- Gnomonia iliaui*, notes, 45.
- Goats—
 Angora, history and management, U.S.D.A., 478.
 distribution in South America, 269.
 international trade, 675.
 investigations, 766.
 lactating, calcium balance experiments, 74.
 milch, management and breeding, 879.
- Goiter in pigs, remedy, Mont., 374.
- Gonad extracts, sex-specific effect, 572.
- Gonads, transplantation, effects, 266.
- Gongylonema scutatum* in sheep, 685.
- Gonia capitata*, parasitism by, 247.
- Gooseberries—
 breeding experiments, 39.
 insects affecting, 243.
 pectin content, factors affecting, 207.
 storage studies, 338.
- Gooseberry—
 diseases, 243, 646.
 mildew, notes, 448, 741.
- Gophers, destruction, 151, 455.
- Graafian follicle of the sow, musculature, 483.
- Grafting wax, preparation, Hawaii, 640.
- Grain—
 Act of Canada, amendments, 694.
 adulteration, relation to Food and Drugs Act, 228.
 and forage, amount for work animals, Ill., 678.
 aphid, spring, method of study, 245.
 crops, value of research on, 29.
 elevators, pneumatic, 689.
 experiments in Africa, 227.
 for pigs on forage, amount, Ohio, 368.
 future trading in, 291.
 germination as affected by carbon dioxide, 323.
 germination, effect of dead leaves in rain water, 813.
 judging for boys' and girls' clubs, 296.
 marketing, country, 290.
 markets, terminal, 291.
 pests, parasites of, 558.
 proteins, supplementary value, 161.
 salvaged, feeding value, 674.

Grain—Continued.

smuts, germination, relation to H-ion concentration, Mo., 344.

(See also Cereal smut, Smut, and specific grains.)

trade of Canada, 496.

vitamin content as affected by soil fertility, 624.

(See also Cereals, and Oats, Rye, Wheat, etc.)

Gram—

culture experiments, 437, 634.

fertilizer experiments, 437, 634.

irrigation experiments, 634.

rotation experiments, 437.

stain, modification, 431.

variety tests, 437, 634.

Grange, work of, treatise, 695.

Granulomata in southern Australia, studies, 184.

Grape—

chlorosis, 745.

court-noué, notes, 745.

cuttings, one-eye, 338.

diseases, 745.

downy mildew, control, 453.

industry of California, status, 40.

juice, clarification, U.S.D.A., 617.

juice, desiccated, antiscorbutic value, 359.

juice, methyl anthranilate in, 207.

leafhoppers, control, 852.

marc, utilization, 509.

mildew, downy, in Algeria, 745.

mildew, downy, in Australia, 849.

mildew, downy, new remedies, 745.

mildew, treatment, 48.

Oidium, control, 448.

phylloxera. (See Phylloxera.)

rot, control, 543.

stocks, phylloxera-resistant, Calif., 540.

Grapefruit—

juice, clarification, U.S.D.A., 617.

juice, desiccated, antiscorbutic value 359.

peel, jellied, 258.

pink-fleshed, bud sport origin, 339.

ripening and storage, 339.

Grapes—

American, culture experiments in India 735.

cordon pruning, Calif., 540.

culture, Calif., 540; Mo., 140.

culture in Greece, 642.

hardiness, Tex., 335.

improvement in Germany, 40.

increasing yields, 842.

insect and fungus enemies, U.S.D.A. 235.

irrigation, Calif., 40.

Muscadine, improvement and use, 40.

Muscadine, variety tests, S.C., 733.

planting and disbudding dates, 736.

production and distribution, Iowa, 736.

pruning, Calif., 540.

stocks for, 642.

variety tests, Hawaii, 640; S.C., 733.

Grape-seed oil, composition, 613.

Grapevines—

frosted, treatment, 642.

injury by freeze and hail, 745.

Graphiola phoenixis, notes, 647.

Grass—

mixtures on grasslands and pastures, 131.

pest, new, in Queensland, 559.

Grasses—

breeding, principles, 129.

culture experiments, Guam, 725.

fertilizer experiments, Mass., 19.

for live stock feed, Hawaii, 633.

insects in, relation to crops, 457.

introduced, studies, Guam, 440.

microscopic identification, 531.

of Florida, 30.

of New South Wales, 638.

variety tests, Hawaii, 633.

wild, relation to wheat rust, 449.

(See also Meadows, Pastures, and specific kinds.)

Grasshopper, repellents, 657.

Grasshoppers—

control, 153.

in Manitoba, control, 458.

of Tennessee, keys, 153.

poison bait for, 53, 657.

(See also Locusts.)

Grassland—

management, 727.

reclamation by juniper, 542.

structure, rôle of grazing in, 28.

(See also Grass, Meadows, and Pastures.)

Gravel for roads. (See Road materials.)

Green bug. (See Grain aphid, spring.)

Green manure—

decomposition, N.Y. Cornell, 212.

effect on quality of potatoes, 441.

fertilizing value, 817, 818.

Green manuring—

effect on rock phosphate availability, 320.

experiments, 623; N.J., 514; R.I., 213.

Greensand as source of fertilizer potash, 719.

Ground squirrels. (See Squirrels, ground.)

Growth—

and development of pig, embryonic, 263.

and reproduction on simplified food supply, 862.

in pigs, relation to vitamin A, 64.

rate of animals, 672.

studies with rats, 264, 566.

Growth-promoting accessory. (See Vitamin.)

Gryllus domesticus. (See Cricket, house.)

Guam Station, report, 793.

Guano, bat, deposits of Rhodesia, 320.

Guano, fertilizing value, 321.

Guavas—

culture experiments, 735.

pruning experiments, 735.

studies in India, 640.

- Guinea pigs—
 effect of lactation on sexual cycle, 871.
 inheritance in, Kans., 476.
- Gymnosporangium*—
 clavipes, temperature of spore germination, N.H., 343.
 juniperi-virginianae, notes, 451.
Gymnosporium macropus, notes, 543.
- Gypona octolineata*, biology, 51.
- Gypsum—
 ammonium carbonate transformation with, 819.
 ammonium nitrate, composition and action, 820.
 effect on soil reaction, 719.
 fertilizing value, 123; Iowa, 321; Oreg., 215.
 for conservation of liquid manure, 818.
 in South Australia, 821.
- Habrobracon brevicornis*—
 rearing, 456.
 studies, 463.
- Habrobracon*, new species, 58.
- Habronema*, treatment for, 686.
- Habronemiasis*—
 diagnosis, technique, 82.
 studies, 184.
- Haddock oil, vitamin A content, 567.
- Hadena oleracea*, control, 53.
- Haematopinus suis*, biology and histology, N.Y.Cornell, 853.
- Haemodipsus ventricosus*, tularemia transmission by, 152.
- Haemonchus*—
 contortus extracts, experiments, 379.
 contortus in goats, 883.
 contortus in sheep, 685, 882.
 spp., studies, La., 281.
- Haemophysalis punctata*, notes, 484.
- Hair, anthrax infested, disinfecting, 480.
- Hair, causes of whiteness in, 264.
- Hairlessness in pigs, remedy, Mont., 374.
- Hamaspora gedeani*, notes, 829.
- Haploa lecontei*, injurious to apple trees, Ky., 157.
- Hardwood diseases, 454.
- Hardwoods, windfall injuries, 645.
- Harmolita phyllotachitis* n.sp., description, 857.
- Harness repairing, 891.
- Harvard Forest, management, 842.
- Harvest labor, historical account, 389.
- Hawaii Station, report, 698.
- Hawthorn blossom weevil, life history and habits, 463.
- Hay—
 feeding value, 765; Wyo., 676.
 (See also specific kinds.)
 fertilizer experiments, 726.
 grades, 30.
 inspection and grading, U.S.D.A., 228.
 liming experiments, Md., 321.
 marketing at terminal markets, U.S. D.A., 130.
 preparation and marketing, U.S.D.A., 129.
- Hay—Continued.
 v. oat and wheat straw, 765.
 weighing for market, U.S.D.A., 228.
 yields in New Jersey, 225.
 (See also Meadows, Grass, and Alfalfa, Clover, Timothy, etc.)
- Health—
 books for school children, 898.
 education in rural schools, 194.
 rural v. city, 294.
- Heat—
 insulating materials, tests, 692.
 loss through types of building, 691.
 production by bees in winter, U.S.D.A., 254.
 (See also Temperature.)
- Heating systems—
 for animal shelters, 491.
 radiation calculation charts, 386.
- Heifers, protein requirement for growth, Mo., 371.
 (See also Cows.)
- Heliothis obsoleta*. (See Cotton bollworm.)
- Heliothrips indicus*, studies, 559.
- Heliotropism, theory, 527.
- Helium, anaerobic experiments with, 25.
- Hellebore, black, diseases, 44.
- Helminthosporium*—
 gramineum, notes, 545.
 sacchari, notes, 45.
 spp., notes, 240, 544, 845.
- Hemicellulose digestion in higher animals, 69.
- Hemileia vastatrix*, notes, 844.
- Hemirhipus fascicularis*, enemy of hickory beetle, N.Y.Cornell, 250.
- Hemiteles micator*, synonymy, 857.
- Hemlock—
 undescribed timber decay, 348.
 western, of British Columbia, 236.
- Hemoglobinuria in cattle, 684.
- Hemophilic bacilli, growth requirements, 78.
- Hemorrhagic septicemia. (See Septicemia.)
- Hemotoxins from parasitic worms, 379.
- Hemp—
 determination of flexibility, 230.
 industry in Ireland, 834.
- Hempseed oil, production, 636.
- Hendersonia sacchari*, notes, 45.
- Hen-peacock hybrids, 575.
- Hens—
 inheritance of egg color and broodiness, 272.
 laying, as affected by calcium, 876.
 laying, feeding experiments, 875; Ind., 574; Ky., 875; Tex., 365.
 laying, housing, 782.
 (See also Egg production.)
 position of keel bone, relation to egg production, 770.
 selection experiments for egg production, Oreg., 171.
- Heredity—
 in Daturas, 430.
 in guinea pigs, Kans., 476.
 in Karakul-Rambouillet sheep, 271.

Heredity—Continued.

- in Matthiola, 223.
- in Orthoptera, Kans., 476.
- in ostriches, 573.
- in parasitic wasps, 463.
- in pigs, 766.
- in red clover, 438.
- of abnormal haulm type of potato, 126.
- of belting spotting in cattle and pigs, 268.
- of color. (See Color inheritance.)
- of disease resistance in beans, 546.
- of earliness in wheat, 35.
- of egg color and broodiness, 272.
- of ramose inflorescence in corn, U.S. D.A., 229.
- of rogues in peas, 37.
- of rust resistance in oats, 545.
- of seed color in red clover, 634.
- of yielding ability in apples, 234.
- process, logos of, 267.
- sex-linked, in poultry, Mo., 370.
- studies, 27.
- (See also Linkage, Mutation, and Variation.)

Hermaphroditism, artificial, in rats, 265.

Herrings, cold storage, experiments, 258.

Hesperioidea of America, 247.

Hessian fly—

- dates for control measures, Mo., 249.
 - method of study, 245.
 - notes, Ohio, 351.
 - parasites, distribution, 464.
 - rate of multiplication, U.S.D.A., 352.
- Heterakis papillosa*—
- development in fowl, 281.
 - in turkeys, 687.
 - studies, 84.

Heterandria formosa, studies, 157.

Heterophyidae, synopsis and new genus and new species, 151.

Heterosporium syringae, notes, 44.

Heterothallism and similar phenomena, 529.

Hevea brasiliensis. (See Rubber.)

Hickory borer, painted, summary, N.Y.Cornell, 249.

Hides—

- international trade, 675.
- unhairing, test of lime for, 114.
- (See also Skins.)

Highway research, U.S.D.A., 86.

Highways. (See Roads.)

Hippeastrum mosaic, ameboid bodies in, 743.

Histidin, effect on starch hydrolysis, 708.

Histogenesis, dynamics of, studies, 262.

Histology, vegetable, elements, 322.

Hog cholera—

- antiserum production, value of tissue extracts in, 183.
- control in Massachusetts, 681.
- form in British East Africa, 778.
- immune serum, desiccation, 884.
- immunity and transmission of tuberculosis, Mo., 379.
- immunization and botulism, 379.
- notes, 773.

Hog cholera—Continued.

- relation to garbage feeding, 874.
 - serum, *Bacillus botulinus* in, 379.
 - studies, Mass., 81.
- Hog—
- feeds, analyses, Can., 168; Mich., 168.
 - houses and equipment, Iowa, 386.
 - houses, sunshine efficiency, 99, 891.
 - louse, biology and histology, N.Y.Cornell, 853.
- Hogging down alfalfa and clover, S.C., 768.
- Hogs. (See Pigs.)
- Hollyhock seed and oil, composition, 11.
- Holotrichia leucophthalma* on rubber, 461.
- Home demonstration work, 393; U.S.D.A., 94.
- Home Economics Association, extension section, 792.
- Home economics—
- at experiment stations, editorial, 601.
 - education, administration course at Harvard University, 799.
 - elementary, textbook, 296.
 - extension, Ill., 597.
 - home projects in, 296.
 - instruction, coordinating with home life, 792.
 - natural sciences as basis, 792.
 - teaching, home project method, 296, 497.
 - textbook, 792.
 - (See also Vocational education and Household.)
- Home making instruction, projects, 296.
- Home projects in home-making education, 296, 497.
- Hominy—
- analyses, N.H., 675.
 - feed, analyses, Mich., 168; Tex., 675.
- Homoiesoma nebuella* on sunflower, 51, 459.
- Honey—
- artificial, examination, 507.
 - artificial, standard, 416.
 - from cotton plant, 160.
 - production, effect of hybridization on 51.
 - production in California, 159.
- Honeybees. (See Bees.)
- Hookworms—
- carbon tetrachlorid for, 282.
 - extracts, experiments, 379.
 - in dogs, treatment, 686.
 - in foxes, remedies, 184, 185, 886.
 - treatment with distol, 684.
- Hopkins host selection principle, experiments, 353.
- Hoplopleura, new species and subspecies, 246.
- Hopperdozer for control of cucumber beetle, 856.
- Hormodendron cladosporoides* in sugar solution, studies, 206.
- Horse—
- and ass, comparative osteology, 875.
 - bots. (See Bots.)
 - labor, cost, 784.

Horse—Continued.

mange, occurrence in Great Britain, 178.

pox and coital exanthema, 778.

Horsehair, disinfection, practicability, 281.

Horse-radish root rot, N.J., 548.

Horses—

as affected by Sudan grass, 678.

breeding in Canada, 872.

digestion experiments, 68; Mass., 476.

draft feeding experiments, Ill., 369.

feeding experiments, Ill., 369, 677; U.S. D.A., 531.

grading, indices and use in, 573.

in China, 573.

internal parasites of, 885.

international trade, 675.

intestinal parasites of, 685.

Morgan, breeding, U.S.D.A., 369.

strongylid parasites of, 485.

Horticulture, development in California, 37.

House fly, chemotropism, 460.

Household—

arts for junior high schools, 597.

chemistry, laboratory outline, 296.

(See also Home economics.)

Howardula benigna, parasite of cucumber beetle, 461.

Humidity—

effect on bean weevil, 661.

effect on moisture determination in leather, 205.

Humming birds, synopsis and catalogue, 555.

Humus—

acid, effect on nitrogen fixation, 715.

investigations, Iowa, 317.

soils, phosphoric acid in, 715.

Hunger-osteomalacia in Vienna, 568.

Hybridization—

experiments with barley, 531.

experiments with peas and beans, 430.

of spontaneous variants, 430.

studies with potatoes, 834, 835.

(See also Animal breeding, Plant breeding and specific animals and plants.)

Hydathodes and stomata in *Campanula*, 523

Hydnum sp. on blazed trees, 151.

Hydrocyanic acid—

formation in plants, 630.

in Sudan grass, 179.

injury to plants, 641.

Hydrogenation, effect on vitamin content of oils, 565.

Hydrogen-ion concentration—

control, buffered salt solution for, 804.

determination, 614, 804.

effect on amylase activation, 325.

effect on mosquitoes, 660.

effect on tetanus bacilli, 683.

for determining changes in milk, Mich., 479.

in soils, relation to lime requirement, 812.

measurement, 110.

of cane juice, effect on decolorization

508.

Hydrogen-ion concentration—Continued.

of Carmel Valley soils, 26.

of media, change during heating, 413.

of soil as affected by sulphur, 428.

of soil, relation to plant distribution 432, 525.

Hydrophobia. (See Rabies.)

Hygiene—

and preventive medicine, treatise, 859.

veterinary, treatise, 178.

Hygroscopicity of soil, 810.

Hylastes ater, notes, 558.

Hylemyia antiqua, life history and control 352.

Hylobius pales, life history and control, 253.

Hyostrongylus, new genus, erection, 151.

Hyphantria cunea. (See Webworm, fall.)

Hypoderma larvae in goats, 777.

Hypoderma spp., control, 684.

Ice cream—

manufacture, effect of each ingredient, Mo., 372.

mixes, methods of calculating, 681.

sandy, 880.

standards in Wisconsin, 681.

studies at experiment stations, 606.

Ice house, farm, design, Mich., 588.

Ichneumon flies, North American, 464.

Ichneumonidae—

economic importance, 51.

Thomas Say species, 254.

Ictero-hemoglobinuria in cattle, 684.

Idaho Station—

notes, 195.

publications available, 698.

Idiocerus populi, notes, 852.

Illinois—

Beekeepers' Association, report, 463.

Station, notes, 499, 794.

University, notes, 298, 499, 699, 794.

Immigrant colonies, Americanization, 191.

Immunity—

role of lipoids in, 276.

vaccination, and serum therapy, treatise, 880.

(See also Anthrax, Hog cholera, Tuberculosis, etc.)

Immunotherapy, nonspecific, 774.

Inanition—

calorimetric studies, 359.

effect on development and structure of testes, 265.

effect on pregnant rats and young, 264.

Inbreeding—

and cross-breeding in *Crepis*, 223.

and relationship, Pearl's coefficients, 268.

(See also Hybridization and Animal and Plant breeding.)

Indicator plants, 28.

Indicators—

change in sensitiveness, 614.

joint use of two, 413.

Indigo—

production, 203.

seed, deterioration in storage, 133.

Indol production as affected by peptone, 180.

Industrial wastes from stockyards, use, 783.

Infants—

fecal flora, bacteriological study, 571.

fed dry milk powder, metabolism, 756.

feeding, caseins of cow's and human milk, 261.

feeding, dry milk products in, 863.

feeding, mineral elements in milk formulas, 862.

feeding, yeast as growth stimulant, 759.

(See also Children.)

Influenza bacilli, growth studies, 78, 79, 80.

Influenza, equine. (See Pleuropneumonia.)

Influenza of man and horse, comparison, 278.

Inheritance. (See Heredity.)

Inosite hexaphosphoric acid in maple seed, N.Y.State, 308.

Insect—

life, treatise, 456.

pests and plant diseases, simultaneous treatment, 851.

Insecticides—

analyses, Conn.State, 522.

composition and use, Mass., 38.

dust, value, N.J., 556.

inspection and analyses, Mich., 444.

new, 51, 748.

uses and manufacture, 152.

(See also Sprays and specific forms.)

Insects—

and injuries from, treatise, 456.

as food, 356.

cold-storage control, 353.

control, 336, 852.

economic, in Queensland, 49.

excluded from Hawaii, 457.

field book, 49.

forest. (See Forest insects.)

function in fruit pollination, 840.

garden. (See Garden insects.)

habits and metamorphoses, 851.

immigrants in Hawaiian Islands, 656.

in Great Britain, 656.

injurious—

in Canada, 748.

in Dutch East Indies, 343.

in Fiji, 245.

in Jamaica, 656.

in Morocco, 851.

in Nigeria, 656.

in Scotland, 656.

in South Africa, 153.

in South Dakota, 50.

in Travancore, 656.

in Union of South Africa, 748.

in West Indies, 557.

to fruit trees, 656, 852.

(See also Corn, Cotton, Sugar cane, etc.)

method of study, 245.

on imported stock, 748.

Insects—Continued.

orchard. (See Fruits, insects affecting.)

relation to man, textbook, 152.

respiration, studies, 456.

scale. (See Scale insects.)

studies, 747.

transformation, treatise, 456.

transmitting diseases in Venezuela, 852.

Insulating materials, tests, 86, 692.

Insurance—

crop, U.S.D.A., 787.

crop, method, 788.

in agriculture in Argentina, 592.

unemployment, in agriculture, 495.

International—

Association of Dairy and Milk Inspectors, 174.

catalogue of bacteriology, 222.

catalogue of serum physiology, 222.

Intestinal—

flora as affected by diet, 666.

parasites of horses, treatment, 685.

worms in pigs, prevention, 685.

Invert sugar, determination, table for, 506.

Invertase—

activity of yeast, effect of stimulating substances, 759.

for sucrose determination, 506.

in sirup manufacture, 312.

Iodin method for determining soil acidity, error in, 503.

Iodometric studies, 615.

Ions, effect on rate of diffusion, 127.

Iowa—

College, notes, 195, 794.

Station, notes, 794.

Station, report, 394.

Ipidae, North American, new genera and species, descriptions, Miss., 461.

Iridomyrmex humilis arrogans, notes, 851.

(See also Ants, Argentine.)

Iris sawfly, oviposition and habits, 857.

Iris, classification, 842.

Iron—

availability as affected by ammonium sulphate, N.J., 526.

colloidal, effect on basal metabolism, 356.

effect on spring wheat, 629.

importance in nutrition, 259.

sulphate, fertilizing value, 522.

(See also Ferrous.)

Irrigation—

along the Nile, effect, 495.

canals, seepage losses, 84.

development of institutions under, 595.

experiments, Mich., 537.

(See also Corn, Cotton, Wheat, etc.)

in Canada, 487.

in India, 84, 487, 779.

in New Zealand, 886.

in South Africa, 487.

in tropical climates, treatise, 282, 584.

reports, 84.

- Irrigation—Continued.
 water, analyses, 117.
 water, field examination for, 282.
 water, saving, in wheat growing, 487.
- Ischnorrhynchus resedae*, studies, N.Y. Cornell, 465.
- Ivory-nut, mannose preparation from, 612.
- Ixodes ricinus*, notes, 484.
- Japanese—
 beetle larvae in balled earth about roots of conifers, 251, 252.
 beetles, control, 661.
 cane. (See Sugar cane.)
 Society of Veterinary Science, journal, 900.
- Jewish Agricultural and Industrial Aid Society, report, 693.
- Johne's disease and detection, 682.
- Johnson grass prussic acid, poisonous to cattle, 484.
- Joint-ill—
 in foals, treatment, 278.
 of lambs, etiology, 776.
- Jointworm, notes, Ohio, 351.
- Jola, root parasites, 343.
- Jowar—
 culture experiments, 437.
 fertilizer experiments, 437.
 prussic acid in, 722.
 rotation experiments, 437.
 variety tests, 437.
- Juglans californica quercina*, abscission of fruits, 529.
- Juniper webworm, notes, 750.
- Junipers, natural reproduction on open areas, 542.
- Jute—
 culture and manufacture, treatise, 134.
 culture experiments, 131.
 determination of flexibility, 230.
 experiments in Bengal, 32.
 fertilizer experiments, 131.
 in Bengal, treatise, 533.
 industry in India, 834.
 industry in Ireland, 834.
 variety tests, 131.
- Kafir—
 chop, analyses, Tex., 675.
 meal, analyses, Tex., 675.
 seeding experiments, U.S.D.A., 637.
 yields, Mo., 326.
- Kainit, fertilizing value, 626.
- Katataraballi, identity, 843.
- Kale, hardening process in, Mo., 827.
- Kansas—
 College, notes, 195, 395, 794.
 Station, notes, 195, 794.
 Station, report, 498.
- Kaolin, origin in middle Germany, 219.
- Kelp, potash from, 23.
- Kentucky Station—
 notes, 395.
 report, 297, 898.
- Keratomalacia, nutritional, in infants, 63.
- Kerosene-gasoline mixtures, flash and burning points, 490.
- Kieselguhr—
 for fruit juice clarification, U.S.D.A., 616.
 use in clarifying cane juice, 508.
- Kikuyu grass blotch, 544.
- Kitchens, design and equipment, U.S.D.A., 89.
- Kraal manure, fertilizing value, 818.
- Labor. (See Agricultural labor.)
- Lachnosterna antiquae*, life history, notes, 559.
- Lactalbumin, hydrolysis, monamino acids in, 503.
- Lactation, effect on sexual cycle in rats and guinea pigs, 871.
- Lactic—
 acid, type produced by starters, Iowa, 77.
 starter, Streptococci in, 76.
- Lactobacilli in corn meal, 356.
- Lactobacillus*—
arabinosus, suggested name, 503.
pentaocticus, suggested name, 503.
pentosus, suggested name, 503.
- Lactose in presence of other sugars, determination, 311, 807.
- Lagerstroemia species, description, 41.
- Lamb, dressing and cutting on the farm, Iowa, 477.
- Lambs—
 digestion and nitrogen-balance trials, 67.
 feeding experiments, 676; Ind., 477; N.Mex., 365; Oreg., 170; Tex., 365.
 production of twins, factors affecting, U.S.D.A., 170.
 wool as affected by thyroidectomy, 72. (See also Sheep.)
- Land—
 allotments in England and Wales, 591.
 clearing, engineering developments in, 98.
 credit. (See Agricultural credit.)
 grant colleges. (See Agricultural colleges.)
 leases, Ohio, 394.
 ownership of farms, 893.
 plaster. (See Gypsum.)
 settlement in New South Wales, 389.
 tenancy in Argentina, 293.
 tenure and customs in the Sudan, 591.
 tenure and transfer in Scotland, 785.
 tenure in Australia, 895.
 tenure in Cotton Belt, 189.
 values, unimproved, proposed tax on, 592.
- Lands—
 arid grazing of Southwest, tenure, U.S. D.A., 784.
 cut-over. (See Cut-over land.)
 forest. (See Forest land.)
 government, homesteading, 91.
 swamp. (See Swamp.)

Landscape gardening, treatise, 236.

Laphygma—

exempta in Queensland, 658.

frugiperda. (See Army worm, fall.)

Larch, needle-cast fungus, studies, 554.

Lard—

international trade, 675.

shortening value, 258.

suet in, detection, 14, 311.

vitamin content, 259.

Lasioderma serricorne. (See Cigarette beetle.)

Lasiodiplodia theobromae, notes, 44, 45.

Lasius niger, notes, 51.

Lasiopyresia molesta. (See Peach moth, oriental.)

Lawn insect, notes, 659.

Lead—

arsenate, insecticidal value, Mich., 443; N.J., 556.

arsenate, preparation, U.S.D.A., 235.

red, use in paint, treatise, 688.

Leaf—

moth, small, an account, 247.

roll and leptonecrosis, relation, 649.

spot disease, bacteriolytic action, 44.

Leather—

industry, anthrax prophylaxis in, 682.

international trade, 675.

manufacture, handbook, 313.

moisture determination in, effect of humidity, 205.

oil and grease extraction from, 114.

water extraction from, 114.

Leaves—

dead, toxic action on germination, 813.

respiration rate, 25.

Legume hay, feeding value, Ill., 678.

Legume seeds, nutritive properties, 161.

Legumes—

in drills with corn, tests, R.I., 226.

inoculated, as nitrogenous fertilizers, 518.

inoculation methods, 830.

(See also Nodule production.)

nitrogen content as affected by fertilizers, 120.

nitrogen fixation by, 514.

production in Spain, 696.

(See also Green manures and Alfalfa, Clover, etc.)

Lemon juice—

desiccated, antiscorbutic value, 359.

preservation, 475.

sterilized, antiscorbutic value, 761.

Lemons—

California, composition, U.S.D.A., 140.

studies in India, 640.

Lepidiotia albohirtum, life history, 159.

Lepidoderma albohirtum, life history, 159.

Lepidoptera, new species, in National Museum, 157.

Lepidopterous larvae of South Africa, food plants, 247.

Lepisma spp., habits and control, Mich., 558.

Leprosy, chaulmoogra oil for, 579.

Leptocoris—

acuta, life history and control, 458.

varicornis, notes, Guam, 748.

Leptonecrosis and leaf roll, relation, 649.

Leptosphaeria—

contothyrum, notes, 143.

herpotrichoides, notes, 44.

sacchari, notes, 45, 647.

spp., notes, 647, 845.

vagalunda, notes, 242.

Leptus spp., notes, 255.

Lepedeza. (See Clover, Japan.)

Lettuce—

downy mildew, control, Iowa, 345.

hardening process in, Mo., 827.

hardiness, varietal differences, 838.

head production, Idaho, 839.

irrigation experiments, Mich., 537.

rust, 43.

variety tests, Guam, 734; Ohio, 336.

Leucite—

fertilizer experiments, 626.

solubility, 627.

Leucotermes lucifugus, chloropicrin for, 656.

Levuana iridescens in Fiji, 247.

Levulinic acid in foods, detection, 416.

Levulose, determination, table for, 506.

Lice, sucking, monograph, 246.

Life zones of Canada, correction, 655.

Light—

action on colloidal chlorophyll, 825.

artificial, effect on egg production, 678; Ky., 875; N.J., 574.

colored, effect on plant growth, 325.

effect on plant growth, 224.

(See also Sunshine.)

Lignum-vitae, uses and importance, 446.

Lilac diseases, 44.

Lily bacterial disease, 244.

Lime—

analyses, 719; R. I., 221.

and chalk on Essex soils, 521.

and clay, insecticidal value, 51.

arsenate. (See Calcium arsenate.)

as fire blight remedy, 451.

as prevention of borax injury, 123.

availability of calcium oxid in, 114, 310.

available in quicklime and hydrated lime, 310.

borax and soda, injurious effect, 521.

burning and grinding plants in New Zealand, 220.

burnt, effect on swamp soils, 319.

chlorinated, for sterilizing milk utensils, 175.

content of dairy products, 680, 710.

cost on farm, 220.

different forms, fertilizing value, Md., 321.

effect on citric acid solubility of basic slag, 23.

effect on nitrate production, 515.

effect on nitrogen content of soil, 425.

Lime—Continued.

- effect on soy beans, N.J., 534.
- factor and lime-potash law, theory, 425.
- for grassland, forms, 436.
- niter. (See Calcium nitrate.)
- nitrogen. (See Calcium cyanamid.)
- process in sugar manufacture, 616.
- registered brands, 24.
- requirement of soils. (See Soils.)
- scrub, control, 448.
- sources and use in England, 821.
- sulphur, form for scab control, Mich. 443.
- sulphur, liquid, insecticidal value N.J., 556.
- uses, outline, 821.
- v. chalk for barley and wheat, 716. (See also Calcium and Liming.)

Limequat, Eustis, new hybrid, 40.

Limes, fertilizer and budding experiments, 40.

Limestone—

- analyses, 719.
- effect of fineness, 23, 122.
- effect on nitrate production, Mo., 315.
- high-magnesium and high-calcium for acid soils, R.I., 220.
- magnesian and nonmagnesian, 425.
- of North Carolina, 521.
- spreaders, Iowa, 385.

Liming—

- effect on availability of soil potassium, phosphorus, and sulphur, 24.
- experiments, 625; Oreg., 215.
- experiments in Rhodesia, 817.
- experiments on soils of Wales, 122.
- experiments, summary, 427.

(See also Lime and special crops.)

of humus soils, importance, 621.

with crop rotations, 426.

Limnerium disparis, parasitism by, 457.

Linear bug on sugar cane, 246.

Linkage—

- in mice, 268.
- in poultry, 769.

Linseed—

- cake, analyses, Can., 168; Mich., 168.
- meal, analyses, Mich., 168; N.H., 675; Tex., 675.
- meal and screenings, oil feed, analyses, Mich., 168.
- meal, feeding value, Ind., 477.

Lipoids, rôle in infection and immunity, 276.

Liquids, distilling apparatus, 414.

Liquids, opacity, measuring, 111.

Litchi, culture, 235.

Lithium in plants, Colo., 28.

Live stock—

- diseases. (See Animal diseases.)
- distribution in South America, 269.
- freight rates, 894.
- industries in China, 573.
- industry in Belgium, government aid, 292.
- insects affecting, 558.
- international trade, 675.

Live stock—Continued.

marketing, cooperative, in Missouri, 390.

poisoning by Mexican whorled milkweed, U.S.D.A., 280.

poisoning by sneezeweed, U.S.D.A., 82.

sanitary laws of Montana, 81.

shipping associations, cooperative, 595.

shipping, cooperative, in Iowa, Iowa, 90.

statistics of Canada, 293.

(See also Agricultural statistics.)

(See also Animals, Cattle, Sheep, etc.)

Liver, autoxidizable constituent, 110.

Lixiviator, description, 23.

Loco weed, eradication, Mont., 334.

Locust—

borer, relation to *Solidago* species, Ky., 57.

seventeen-year. (See Cicada, periodical.)

Locusts—

- control in Uruguay, 853.
- control, international conference, 853.
- control, summary, 748.
- Moroccan, in Crau, 851.
- outbreaks and control, 657. (See also Grasshoppers.)

Logan beetles, spraying for, 460.

Loganberry crown gall, notes, 143.

Lonchaea aristella, enemy of fig in France, 248.

Logan, culture, 235.

Longitarsus parvulus on flax, 743.

Loranthus on mango, 343.

Loranthuses, damage to trees by, 245.

Louisiana Stations, notes, 395.

Loaostege spp., control, 153.

Lubricants, effect of graphite, 782.

Lubrication—

and lubricants, 781.

viscosity and friction, 688.

Lucern. (See Alfalfa.)

Lumbang oil, analyses and solubility, 109.

Lumber—

industry and export trade of Finland, 237.

(See also Timber and Wood.)

Lumpy jaw. (See Actinomycosis.)

Lupines, new rot of, 241.

Lycoperdon furfuraceum, notes, 544.

Lycophotia margaritosa saucia, life history, 660.

Lygus pratensis. (See Tarnished plant bug.)

Lymnaea phragmitella, studies, N.Y.Cornell, 465.

Lymphocytes, function in nutrition, 867.

Lymphoid tissue, function in nutrition, 867.

Lysimeter—

experiments, N.Y.Cornell, 210.

installations at Craibstone farm, 811.

Macadamia nuts, variety tests, Hawaii, 640.

Machinery. (See Agricultural machinery.)

Mackerel, California, chemical study, 466.

Macremphytus varians mouth parts, studies, 560.

Macrobasia spp., notes, U.S.D.A., 158.

Macrosporium on citrus, 348.

Macrosporium—

parasiticum, notes, 145.

solani, notes, 447, 451.

solani on tomato, 148.

Magnesia impregnated soils, 316.

Magnesium—

arsenate, insecticidal value, Mich., 443.

as affected by nitrification and sulfonation, Ohio, 430.

determination in blood, 416.

determination in feces, 417.

determination in serum, 203.

determination in urine, 417.

removal from soil, N.Y.Cornell, 210.

silicate, effect on wheat, 717.

sulphate, fertilizing value, 521.

Maine University and Station, notes, 795.

Malze. (See Corn.)

Malacosoma americana. (See Tent caterpillar.)

Malaria control, relation to drainage, 460.

Malaria control, rôle of top minnows in, 157.

(See also Mosquitoes and Anopheles.)

Malnutrition—

relation to tuberculosis, 869.

severe infantile, metabolism in, 762.

(See also Nutrition and Undernutrition.)

Malt diseases and pests, 52.

Malta fever, treatment with collargol, 277.

Mammals—

in Queensland, 49.

morphology of female sex organs, 266.

small, of Colorado, 151.

South African, treatise, 245.

spermatozoa in, survival of motility, 673.

(See also Animals and specific kinds.)

Mammea americana, notes, 737.

Mammitis, contagious, in ewes and goats, 777.

Manganese—

as affected by nitrification and sulfonation, Ohio, 430.

in beets, Colo., 29.

Mange, parasitic, 773.

(See also Horse mange and Sheep scab.)

Mangel—

rust, notes, 741.

seed identification in sugar beet seed, 134.

Mangels—

effect of preceding crop, R.I., 233.

feeding value, 765.

fertilizer experiments, 131.

liming experiments, 131.

rotation experiments, 131.

variety tests, 131, 227.

yields, 533.

Mangoes—

in Australia, weevil pest, 254.

studies in India, 640.

variety tests, Hawaii, 640.

Manioc. (See Cassava.)

Mannitol production in silage, 804.

Mannose, preparation from ivory-nut, 612.

Manure—

action on crops, 424.

and fertilizers, comparison, 623.

and sewage fertilizer, comparison, 319.

application, furrow system, 424.

artificial, 217.

economy tests, 335.

effect on quality of potatoes, 441.

fertilizing value, 818; Oreg., 215; R.I.,

213.

hot composted, fertilizing value, 818.

in Egypt, treatment and storage, 518.

liquid, conservation with gypsum, 818.

liquid, conserved with formalin, effect

on plants, 518.

liquid, prevention of nitrogen loss, 714.

whale, nitrification, 516.

(See also Cow manure and Sheep manure.)

Maple—

disease, 44.

sand, organic acids of, 308.

seed, analyses and composition, N.Y. State, 308.

Maples—

Cytospora chrysosperma on, 850.

distinguishing characteristics, 341.

Marasmyia trapezalis, notes, Guam, 748.

Marasmyia sp., notes, 45.

Mares, native, breeding, Guam, 763.

Margarin—

fats, rancidity, 109.

notes, 276.

(See also Oleomargarin.)

Margaropus annulatus. (See Cattle tick.)

Marigold, Mexican, control in South Africa, 227.

Marine organisms, zinc in, 260.

Market—

analysis, principles and methods, 693.

gardens. (See Truck farms.)

reports, U.S.D.A., 91, 192, 390, 496,

596, 789.

statistics, U.S.D.A., 290.

Marketing—

agricultural products, 593.

butter, methods, 594.

cooperative, and price determination, 594.

efficient, textbook, 289.

in North Carolina, N.C., 390, 595, 789.

methods and policies, treatise, 594.

plan for improvement, 192.

studies at experiment stations, 610.

Markets, public, open types, U.S.D.A., 492.

Marls of North Carolina, 521.

Marsh soils—

drainage experiments, 319.

reclamation and cultivation, 318.

Marsonia juglandis, overwintering, 851.

Massachusetts—

College, notes, 395.

Station, notes, 196, 395, 699.

Station, report, 96.

Mastitis. (*See* Mammitis.)
Matches and matchwood production, 237.
Matricaria nigellaefolia, poisonous to cattle, 776.
Matthiola sp., effect of soil fertility on bloom, 735.
Matthiola varieties, inheritance in, 223.
May beetles, papers on, 51.
Mayetiola destructor. (*See* Hessian fly.)
Mayonnaise, emulsification in, 258.
Meadow—
 hay, fertilizer experiments, 726.
 soils, fertilizer experiments, 319.
Meadows—
 condition in England, 129.
 fertilizer experiments, 726; Del., 624.
 hardpan subsoil treatment, 531.
 papers on, 437.
 permanent, in Denmark, 437.
 run-out, top-dressing experiments, Conn. State, 318.
 (*See also* Hay, Grass, and Grassland.)
Mealy moths, rearing, 456.
Mealy bug, prevention in vineyards, 658.
Meat—
 blowflies on, protection against, 57.
 butchering and curing in China, 764.
 canned, international trade, 675.
 chilled and frozen, black spot in, 860.
 extracts, analyses, 12.
 extracts, artificial, levulinic acid in, 416.
 frozen, international trade, 675.
 inspection in Saxony, 479.
 packing houses, treatise, 491.
 scrap, analyses, Mich., 168; N.H., 675; Tex., 675.
 scrap for pullets, Ind., 574.
 scrap percentage for egg production, Ky., 875.
 spoilage, detection, 753.
 (*See also* Beef, Pork, etc.)
Media. (*See* Culture media.)
Medicinal plants. (*See* Drug plants.)
Medlar leaf spot, 44.
Megninia gallinulae, notes, 885.
Melampsora lini, notes, 743.
Melanconium sacchari, notes, 45.
Melanitis ismeni on rice, 458.
Melanoplus spp., control, 153.
Melanotus hyslopi n.sp., notes, 461.
Melilotus. (*See* Sweet clover.)
Meliola—
 arundinis, notes, 45.
 bicornis, notes, 845.
Meloe sp., notes, U.S.D.A., 158.
Melon aphid, control, 852.
Meningo-encephalitis, epizootic, etiology, 485.
Mercury vapor quartz lamp radiation, effects, 869.
Meria laricis, studies, 554.
Mermis myrmecophila n.sp., description, 752.
Mesta of Shepherds, history, 390.
Metabolism—
 basal, apparatus for determining, 671.

Metabolism—Continued.
 basal, clinical measurement, 260.
 basal, determination, difficulties, 861.
 basal, determination from carbon dioxide elimination, 672.
 basal, effect of colloidal iron, 356.
 basal, of children, standards, 261.
 basal, of infants fed on dry milk powder, 756.
 basal, of women, 166.
 basal, relation to thyroid activity and pulse rate, 861.
 basal, symposium, 260.
 effect of ultraviolet light, 870.
 endogenous purin, effect of diet, 757.
 experiments, rôle of cellulose fermentation in, 69, 70.
 experiments with fat-free diet, 255.
 of fowls, 172.
 of infants with severe malnutrition, 762.
 of negroes in Tropics, 671.
 of pigeons, effect of polished rice diet, 470.
 of roots, Mo., 323.
 of white race in Tropics, 671.
Metarrhizium anisopliae, parasitism by, 560.
Meteorological—
 observations—
 Guam, 711; Ky., 809; Mass., 209; 419, 809; Mont., 314, 830; N.J., 510; N.Y. State, 618; Ohio, 510; U.S.D.A., 16, 115, 209, 419, 618, 808.
 at East Lansing, Michigan, 419.
 in Australia, 131.
 in France, 314.
 in New South Wales, 209.
 in Trinidad and Tobago, 711.
Meteorology—
 agricultural, 208.
 applied, in Italy, 15.
 Brazilian division, 599.
 handbook, 711.
 papers on, U.S.D.A., 115, 618.
 (*See also* Climate, Rainfall, Temperature, Weather, etc.)
Meteorus—
 dimidiatus, parasitism by, 247.
 versicolor, parasitism by, 457.
Methyl—
 alcohol as nutrition for algae, 824.
 alcohol, determination in presence of ethyl alcohol, 505.
 anthranilate in grape juice, 207.
Mice—
 color mutation in, 268.
 linkage in, 268.
 short-eared mutants, 268.
 susceptibility to strychnin, 655.
 (*See also* Rodents.)
Michigan—
 College, notes, 299, 699.
 Station, notes, 699.
 Station, quarterly bulletin, 598.
 Station, report, 498.

Micracis, North American, key, Miss., 461.
 Micracisoides, new subgenus, erection, Miss., 461.

Microbiology of soil, 513.

Micrococcus—

melitensis. (See *Bacterium melitensis*.)

tetragenus, notes, Mass., 81.

Microcolorimeter, new, description, 805.

Microorganism—

growth in, 127.

oxidation of sulphur by, 822.

(See also *Bacteria and Organisms*.)

Microscopy—

elementary chemical, 201.

laboratory manual, 201.

Middlings—

analyses, Can., 167.

with screenings, analyses, Mich., 168.

(See also *Wheat, Rye, etc.*)

Mildew—

downy on apple, 646.

downy, on grape, 453, 745, 849.

downy, on spinach, 45.

on cereals, notes, 239.

powdery, on apple, 144, 453.

(See also *host plants*.)

Milk—

and disease, 879.

and its uses, U.S.D.A., 60.

and legume seed proteins, supplementary value, 161.

bacteria in, little plate method of counting, 175.

bacterial analyses, 174.

bacterial content, S.C., 771.

bacterial content, effect of dirt, 772; Ill., 373.

bacterial count in, value, 176.

bacterial count, variation in, N.Y. Cornell, 274.

bacteriological tests in Dublin, 75.

biological changes in, determination, Mich., 479.

boiled, effect on scurvy, 360.

bottles, brown glass, studies, Iowa, 76.

bottles, glass, manufacture, 76.

buffaloes' analyses, 577.

calcium in, relation to casein digestion, 863.

calcium phosphate in, effect of heat, 802.

cans, empty, cleanliness, 75.

cans, sterilization, 76.

chlorin content after ingestion of salt, 174.

citric acid content, 615.

composition in British East Africa, 273.

condensed, monograph, 258.

control in dairy plants, 75.

control, organization, 174.

cost of production, 771.

cream volume, measurement, Ill., 578.

creaming ability, effect of pasteurization, Ill., 578.

deproteinization, methods, 564.

Milk—Continued.

distribution in New Jersey, 75.

distribution of salts in, 205.

distribution, reforms in, 694.

dried, analyses, 863.

dried, notes, 276.

evaporated, relation of acidity to coagulation temperature, 803.

evaporated, sterilizing, 681.

examination, methods, 75, 113.

fat adulteration, determining, Ind., 205.

fat and solids in, effect of lactation period, 680.

fat as affected by coconut meal feed, Calif., 577.

fat as affected by cottonseed meal, Iowa, 371.

fat content, seasonable variation, 679.

fat, cost of production, 90, 679.

fat of cows on official test, Mo., 371.

fat origin, 878.

fat percentage increased by feed, 679.

fat *v.* cod liver oil, antirachitic value, 471, 472.

food value, 174.

formulas, mineral elements in, 862.

grade "A," bacteriological examination, 176.

grading, rapid acidity test, 205.

growth-promoting properties, 60.

houses, plans, and construction, U.S. D.A., 288.

human and cows', casein in, 261.

human, food proteins in, 564.

industry in Scotland, 679.

international trade, 675.

keeping quality, judging, 175.

laws in Massachusetts, 75.

nutritive-value for white mice, 566.

pasteurization, 174.

pasteurization, effect on creaming ability, Ill., 578.

pasteurizing temperature effect on paratyphoid group, 275.

plant inspectors, qualifications, 175.

plants, bacterial control in, 175.

powder, apparatus for making, 11.

powder, dry, use in infant feeding, 756, 863.

powder, vitamin B in, 61.

prices in New Jersey, 75.

problem in hot climates, 879.

production during heat period, Ky., 372.

production, effect of age and pregnancy, Ky., 372.

production, effect of breeding, Iowa, 371.

production of young cows, 74.

production, relation of labor to, 175.

production, relation to body secretions, Ky., 373.

production, summer, maintenance, Iowa, 370.

production, unsanitary, in England, 879.

products, citric acid content, 615.

Milk—Continued.

- proteins, anaphylaxis reactions, 9.
- proteins, relation to amino acids of blood, 74.
- recording societies, value, 679.
- recording societies, value of food records in, 879.
- records in Scotland, 679.
- remade, studies, 176, 177.
- rennet coagulability, effect of heat, 802.
- ropy, 175.
- secretion as affected by excess of protein, 65.
- secretion, relation to diet, 878.
- secretion, studies, Me., 173.
- skimmed. (*See* Skim milk.)
- smears, staining, 431.
- spoilage, 771.
- substitute for calves, Mo., 371.
- successive portions, variation in fat per cent, 771.
- supply and public health, 281.
- supply of various cities, 174.
- testing, Calif., 578.
- transportation and marketing, 174.
- utensils, sterilization, chlorinated lime for, 175.
- vitamin A content, 357, 680.
- vitamins in, from cows on vitamin-free rations, Kans., 478.

Milkweed—

- insects in New Jersey, 656.
- whorled Mexican, poisonous to live stock, U.S.D.A., 280.

Miller's almanac, 228.

Millet—

- as forage crop, Mass., 30.
- pearl, Linnaean concept, 721.

Millipedes under sash, control, 662.

Milo—

- chop, analyses, Tex., 675.
- cross pollination, 230.
- meal, analyses, Tex., 675.
- seeding experiments, U.S.D.A., 637.
- yields, Mo., 326.

Mine timber, decay and preservation, 454.

Mineral—

- elements in milk formulas for infants, 862.
- mixtures for pigs, Iowa, 73.
- resources of New York, 218.
- resources of United States in 1918, 425.

Minerals—

- importance in diet, 259.
- of California, 627.

Minnesota—

- State flour testing mill, 499.
- University and Station, notes, 396, 699.

Minnows, mosquito-destroying, studies, 750.

Mississippi Station, notes, 396, 795.

Missouri—

- Fruit Station, notes, 499.
- Fruit Station, reports, 297.
- Station, notes, 299.
- Station, report, 394.
- University, notes, 299, 795.

Mistletoes, damage to trees by, 245.

Mites and Isle of Wight disease, 464.

Mitochondria—

- in animals and plants, 824.
- in plant cells, 29, 824.

Mohair, grading, U.S.D.A., 478.

Moisture tester, remedying defects in, 414.

Molasses—

- amids, utilization by ruminants, 67.
- beet pulp. (*See* Beet pulp.)
- determining grain in, 312.
- dry substances in, 507.
- feeding value, Iowa, 362.

Mold hyphae in sugar and soil, 431.

Mollusks, dipterous larvae on, 57.

Monamino acids in lactalbumin hydrolysis, 503.

Monarthropalpus buxi, life history and control, 750.

Mongoose in Kentucky, 455.

Moniezia sp. in sheep, 685.

Monilia fructigena, notes, 453.

Monilochaetes infusans—

- notes, 551.
- on sweet potatoes, effect, 135.

Monomorium spp., notes, 50.

Montana—

- College, notes, 197.
- Station, notes, 197, 795.
- Station, report, 394.

Moor—

- meadows, fertilizer experiments, 530.
- soils, studies, 215.
- (*See also* Peat soils.)

Moringa pterygosperma, notes, 737.

Morphine content, relation to poppy flower color, 125.

Mosaic disease, studies, 344, 743.

Mosquito—

- larvae as affected by H-ion concentration, 660.
- plague, source, 51.

Mosquito-destroying top-minnow, studies, 750.

Mosquitoes—

- and malarial control, 381.
- breeding, 248.
- control, N.J., 557.
- control, papers on, 459.
- embryological studies, 459.
- survey, P.R., 157.
- (*See also* Anopheles, Culex, and Malária.)

Moss rose, origin, 842.

Moth, liparid, injurious to figs, 559.

Moths, Eudemis and Cochylys, in Bordeaux, 851.

Motor—

- cultivators. (*See* Cultivators.)
- fuel, bacterial production, 780.
- fuel, treatise, 87.
- plows. (*See* Plows.)
- truck impact tests, U.S.D.A., 489.
- truck transportation, 890.
- trucks, construction and care, 890.
- trucks, export packing, 383.

- Motor—Continued.
 trucks, high-speed, design, 383.
 trucks in the east, U.S.D.A., 87.
 trucks, treatise, 890.
 vehicles, registration, U.S.D.A., 86.
- Motors, electric, fees and tests, 491.
- Mottling disease of sugar cane. (See Sugar cane.)
- Mouse louse, tularaemia transmission by, 663.
- Muck—
 nitrogen, availability, 120.
 soils, fertilizer experiments, Mich., 518.
- Mucor* sp. in corn meal, 356.
- Mules—
 feeding experiments, Ill.; 677, U.S.D.A., 531.
 international trade, 675.
- Müll, fertilizing value, 720.
- Mungo beans—
 notes, Guam, 726.
 sprouted, vitamin content, 667.
- Musca domestica*. (See House fly.)
- Muscle—
 autoxidizable constituent, 110.
 shoals project, paper on, 522.
- Muscular—
 exercise effect on blood, 475.
 work, physiological cost, 571, 572.
- Mushroom root rot, description, Wash., 449.
- Mushrooms, gill, key, 322.
- Muskmelon fruit rot, 543.
- Muskmelons, variety tests, 839; S.C., 733.
- Mustard—
 mosaic disease, 148.
 seed oil, production, 636.
- Mutation—
 and adaptation as result of fire, 27.
 in house mouse, 268.
 in pure line barley, 531.
 types of, 27.
 (See also Variation.)
- Mutations—
 and anomalies in plants, 524.
 and evolution, 524.
- Mutton—
 dressing and cutting on the farm, Iowa, 477.
 international trade, 675.
- Mycosphaerella*—
bolleana, n.sp., notes, 722.
gossypina, notes, 847.
grossulariae, notes, 243.
 sp., notes, 454.
- Myelophilus piniperda*, notes, 558.
- Myogenesis, tension of differential growth as stimulus, 263.
- Myzus ribis*, production of winged forms, 154.
- Naphthalene, effect on plants, 544.
- Narcissus eelworm disease, control, 553.
- Nasutitermes morio*, notes, 559.
- National—
 Agricultural Conference, editorial, 301
 Formulary of United States, 178.
 Park, Yosemite, handbook, 41.
 parks portfolio, 842.
- Nebraska Station, notes, 396, 700.
- Necrobacillosis—
 intestinal, in shotes, Ky., 884.
 of sheep, Mont., 374.
- Necrology, notes, 199, 400, 599, 799.
- Nectarine scab, 453.
- Nectarines, dried, energy value, 859.
- Nectria*—
ditissima, control, 552.
ipomoeae, notes, 844.
- Negro migration, 189.
- Negroes in Tropics, metabolism, 671.
- Nematocera of Mesopotamia, 59.
- Nematode—
 disease, new, of soy bean, 242.
 parasites of sheep in Pennsylvania, 685.
- Nematodes—
 affecting narcissus, 553.
 new genera, 151.
 penetration into mammals, 882.
- Nematodirus* spp., measurements of eggs, 777.
- Neon light, experiments, 640.
- Nerve stimuli relation to oviducal secretions in birds, 267.
- Nervous system, comparative anatomy, 880.
- Neurotoma inconspicua*, studies, 58.
- Nevada Station, notes, 299, 396.
- New England Research Council, 799.
- New Hampshire Station—
 notes, 197.
 report, 394.
 survey of research, 394.
- New Jersey Stations—
 notes, 795, 899.
 report, 598.
- New Mexico—
 College and Station, notes, 97.
 Station, report, 394.
- New York—
 Cornell Station, notes, 396.
 Cornell Station, report, 898.
 State Institute of Applied Agriculture, 300, 900.
 State Station, notes, 299, 499, 700, 796, 899.
 State Station, report, 698.
- Nicotin—
 dust, insecticidal value, 852.
 dust, preparation, Calif., 350.
 solutions, preparation, U.S.D.A., 235.
- Nightshade, feeding experiments, 674.
- Nippon river fever. (See Tsutsugamushi.)
- Nitrate—
 of ammonia. (See Ammonium nitrate.)
 of lime. (See Calcium nitrate.)
 of soda. (See Sodium nitrate.)
- Nitrates—
 accumulation as affected by straw, 423.
 accumulation as affected by succulency of green manure, N.Y.Cornell, 212.
 accumulation as affected by wheat straw, 622.
 accumulation from decomposition of oil cakes, 714.
 accumulation, relation to soil condition, 813.

Nitrates—Continued.

- amounts in first 5 feet of soil, 515.
- composition and action, 820.
- formation as affected by sulphur, 428.
- production as affected by lime, 515.
- production as affected by limestone, Mo., 315.

Nitrification—

- as affected by fertilizers, 121.
- in South African soils, 514.
- solvent action of, Ohio, 428.

Nitrobenzene, effect on plants, 544.

Nitrogen—

- accumulation in soil, rate, Mo., 315.
- content of soil as affected by lime, 425.
- determination in blood and urine, 615.
- determination, use of perchloric acid in, 615.
- distribution in meat extracts, 12.
- fertilization, 424.
- fixation—

- as affected by acid humus, 715.
- as affected by fertilizers, 120.
- as affected by straw, 424.
- by algae, 824, 825.
- by green plants, 723.
- by inoculated soy beans, 19.
- processes, 820.
- symbiotic, by legumes, 514.

- forms in soy bean nodules, 630.
- in muck, availability, 120.
- in organic compounds, detection, 415.
- lime. (*See* Calcium cyanamid.)
- loss from liquid manure, prevention, 714.
- microdetermination, 12, 709.
- need and use by plants, 224.
- nonprotein, determination, 113.
- products committee report, supplement, 425.

Nitrogenous—

- fertilizers, comparison, 120, 625; S.C., 717.
- fertilizers, development, 124.
- fertilizers for orchard soils, Wash., 817.
- fertilizers for tobacco tests, 638.
- fertilizers, nitrifiability, 516.
- potassic fertilizers, preparation from explosives, 626.
- salts, effect on quality of potatoes, 441.

Nodule—

- bacteria. (*See* *Bacillus radicola*.)
- organisms, life cycle, 124.
- production, effect of soil temperature, 124.

(*See also* Legumes, inoculation.)

Nodules, forms of nitrogen in, 630.

Nomenclature of agricultural plants, 129.

Nonagria oblonga, studies, N.Y.Cornell, 465.

Nonpartisan League, treatise, 292.

North Dakota Station, notes, 700.

Nosema apis, notes, U.S.D.A., 858.*Notaris puncticollis*, studies, N.Y.Cornell, 465.

Nursery stock, imported, insects on, 748.

Nutrient—

- media. (*See* Culture media.)

Nutrient—Continued.

- solutions, acidity, relation to plant growth, N.J., 525.

Nutrition—

- and food chemistry, 355.
- and growth on fat-free diet, 565.
- and vitamins, 256, 257.

(*See also* Vitamins.)

bibliography, 295.

chemistry of, 255.

function of lymphocyte and lymphoid tissue in, 867.

in Vienna, 669.

law of minimum in, 756.

of the dog, relation to vitamin B, 358.

Pirquet system applied to American conditions, 562.

quality of protein in, 255.

relation to food manufacture, 256.

studies, 564, 758; Kans., 475.

(*See also* Diet, Malnutrition, Metabolism, Undernutrition, and Vitamins.)

Nuts—

- culture in British Columbia, Can., 140.
- growing, treatise, 40.

Nyssoninae, new species, descriptions, 160.

Oaks—

- deciduous, of northern Africa, 42.
- durnast, in British Isles, 142.
- growth rings as affected by rainfall, Mo., 16.

Oat—

- and tare silage. (*See* Silage.)
- black rust, life history, 240.
- chop, analyses, Tex., 675.
- crown rust, 240.
- disease survey in India, 544.
- feed, analyses, N.H., 675.
- hulls as hay substitute, 674.
- rust resistance, inheritance, 545.
- rust resistant varieties, Iowa, 144.
- rust, studies, Iowa, 342.
- silage. (*See* Silage.)
- smut, control, 844.
- smut, notes, 239, 240.

(*See also* Smut and Cereal smut.)

- straw v. hay, feeding value, 765.

Oats—

- amino-acid content, 504.
- and corn, feeding value, Ill., 678.
- as affected by calcium, Ky., 816.
- as affected by sulphur, 822; Wash., 427.
- breeding experiments, 638.
- by-products, composition, and digestibility, Mass., 476.
- cost of production, 590; Mo., 387.
- cultural directions, Wash., 437.
- culture experiments, Mo., 834; U.S. D.A. 724.
- decomposition rate in soil, N.Y.Cornell, 212.
- feeding value, Iowa, 363.
- fertilizer experiments, 131, 227.
- Fulghum, history, U.S.D.A., 134.
- grass, liming experiments, 426.
- ground, analyses, Can., 167; Tex., 675.
- hybrid, studies, 231.

Oats—Continued.

- improvement by selection, 830.
- liming experiments, 131.
- oil extraction, 502.
- rolled, analyses, Tex., 675.
- rotation experiments, 131, 819; U.S. D.A., 725.
- seeding experiments, 227, 531; Iowa, 326.
- straw, effect on soil reaction, 211.
- varietal nomenclature, 829.
- varieties, Mich., 633; Tex., 328.
- varieties, analyses, 633.
- varieties, new, description, 531.
- varieties, yields, Kans., 435.
- variety, new, in Sweden, 636.
- variety, new, yields, Iowa, 326.
- variety tests, 131, 227, 531, 633; Mo., 326; Mont., 327; N.H., 328; S.C., 725; Wash., 437.
- yields, Mont., 327.
- yields in Australia, 132.
- yields in New Jersey, 225.

Ocnorhynchus amanda, life history and habits, 559.

Oecanthus nigricornis, notes, 50.

Oesophagostomum columbianum in sheep, 685.

Oestrus, effect on milk production, Ky., 372.

Ohio—

- State University, notes, 97, 396.
- Station, monthly bulletin, 394, 793.
- Station, notes, 396.

Oil—

- cakes, decomposition, nitrates from, 714.
- from grape-seed, composition, 613.
- fungus, digestibility and use, 68.
- manufacture from grape seeds, 509.
- meal. (See Linseed meal.)
- palm diseases in West Africa, 348.
- seeds, South American, studies, 108.

Oils—

- as lubricants, critical temperature, 781.
- chemotherapeutic studies, 579.
- drying films, stress-strain measurements, 586.
- essential, chemistry of, 308.
- extraction from leather, 114.
- hydrogenated, physiological value, 565.
- miscible, spraying experiments, 855.
- nondrying, sources, 109.
- shortening value, 258.
- vegetable, handbook, 202.
- vegetable, production and movement, 636.
- (See also Fats, Corn oil, Cottonseed oil, Olive oil, etc.)

Okra—

- canned, bacterial flora, 859.
- vitamin content, 667.

Oleomargarin industry and vitamin doctrine, 256.

(See also Margarin.)

Olive—

- fly and parasites, 852.
- oil production, 636.
- oils and reaction of Villavecchia, 710.
- scab, cause, 244.

Olives—

- pruning experiments, 140.
- ripe, pickling, 208.
- sterilizing and pickling, Calif., 163.

Oncopera mitocera in Queensland, 559.

Onion—

- diseases, La., 145.
- dormancy studies, 538.
- grass, description and analyses, 639.
- maggot, control, Mass., 50.
- maggot, imported, life history and control, 352.
- mildew fungus. perennial mycelium in, 847.
- pink root, control, Tex., 343.
- seed production, La., 145.
- smut in England, 548.
- smut, relation to climate and culture, 345.

Onions, irrigation experiments, Mich., 537.

Ontario—

- Agricultural College, history, 392.
- Experimental Farm, Western, notes, 398.

Oospora—

- pustulans*, notes, 847.
- scabies*. (See Potato scab.)

Ophiobolus—

- graminis*, notes, 240.
- spp., notes, 44.

Ophthalmia and vitamin A deficient diet, 469.

Opium poppy, flower color in relation to morphine content, 125.

Orange—

- diseases, remedies, 553.
- juice, dried, antiscorbutic value, 261, 359.
- navel, and pomelo crosses, 735.
- peel, jellied, 258.
- peel, vitamin A in, 567.
- scrub, control, 448.

Oranges—

- export of South Africa, cause of waste, 653.
- studies in India, 640.

Orchard—

- insects in Indiana, 458.
- management, 841; Wash., 817.
- management in Hood River Valley, Oreg., 234.
- pests, 52.
- surveys, value to research, 444.

Orchards—

- bird raising in, 741.
- cover crops for, 139.
- cover crops in relation to winter injury, Iowa, 334.
- infection from old isolated trees, 153.
- (See also Fruits, Apples, Peaches, etc.)

Orchid leaf spot, studies, 454.

Oregon—

College, notes, 499, 796.

Station, reports, 698.

Organic acids, formation by *Aspergillus*, 225.

Organic acids, variation during anthocyanin formation, 723.

Organic matter—

effect on soil reaction, 118, 211.

humification in soil, N.Y.Cornell, 212.

in plants, behavior, 324.

in soil, carbon content, 709.

in soil, estimation, 709.

in soil, transformation, 813.

liberation by roots of growing plants, N.Y.Cornell, 323.

solvent effect on rock phosphate, 21.

Organisms—

pathogenic, air carriage of, 773.

thermophilic, thermal death time curves, 561.

(See also Bacteria and Microorganisms.)

Oriental peach moth. (See Peach moth.)

Ornithodoros—

crossi, notes, 881.

talaje, transmitting agent of relapsing fever, 682.

Orthoptera, inheritance in, Kans., 476.

Oryotes rhinoceros, morphology and ecology, 560.

Oscinella frit, habits, 158.

Oscinis frit in winter wheat, 460.

Oslerus, new genus, erection, 151.

Osmotic pressure—

measurement, 631.

rôle in toxicity of salts, 209.

root pressure, and exudation, 431.

Osmosis, rôle in biology, treatise, 126.

Osteoclasts, function, 263.

Osteomalacia, hunger, in Vienna, 568.

Ostertagia circumcincta in sheep, 685.

Ostriches, inheritance of acquired characters, 573.

Otiorthynchid weevils of Florida, specific names, 560.

Otiorthynchus—

ovatus, popular account, 159.

rotundatus, life history, 51.

Ovulariopsis n.spp. from West Indies, 239.

Oxidase acting upon phlorizin, 825.

Ox-warble infestation, preventive treatment, 684.

(See also Bot flies and Warble fly.)

Oxygen—

absorption in respiration, apparatus for demonstrating, 432.

content of bog water, effect of cloudiness, 632.

Oxyurus curvula as affected by thymol, 885.

Oysters—

distribution of zinc in, 260.

growth and food, N.J., 576.

Pachnaeus, specific names, 857.

Paddy. (See Rice.)

Paint—

cold water, preparation and use, 688.

films, stress-strain measurements, 586.

red lead in, treatise, 688.

Paints, fungi injurious to, N.J., 554.

Pales weevil, life history and control, 253.

Palm—

coconut. (See Coconuts.)

disease survey in India, 544.

kernel oil cake, analyses, Can., 168.

kernel oil, steam-distilled, vitamin A content, 256.

leaf spots, 647.

oil, production, 636.

Papaya—

leaf spot, 544.

rot, 454.

Papayas—

breeding experiments, 735.

from home-grown seed, Guam, 733.

studies in India, 640.

variety tests, Hawaii, 640.

Paper diseases, 455.

Paper dress form for dressmaking, U.S.D.A., 792.

Paprikas, changes in composition during growth, 501.

Para grass, culture and feeding value, Guam, 440.

Parabiosis, heterosexual, changes in reproductive organs, 265.

Paradichlorobenzene treatment for peach borer, 156; N.J., 156; U.S.D.A., 156.

Paralysis—

in avian polyneuritis, nature of, 669.

in children due to wood ticks, 59.

Parasites—

cryptogamic, of plants, 448.

intestinal, of animals, 685.

of animals, classification, booklet, 456.

of animals in slaughterhouse, 882.

of foxes, list, 686.

(See also specific parasites.)

Parasitism and symbiosis, 655.

Paratetranychus pilosus in Connecticut, 753.

Paratyphoid bacilli, viability in excrement, 588.

Parks, natural, origin, 28.

Parsnips, lime requirements, R.I., 233.

Parthenogenesis, occurrence and causation, 222.

Paspalum, culture and feeding value, Guam, 440.

Pasteurization. (See Milk and Cream.)

Pastures—

botanical composition, 129.

establishment after forest fires, 142.

fertilizer experiments, 624.

grazing and fertilizer tests, 227.

improvement, 436.

in wheat-growing districts of New South Wales, 638.

irrigated, carrying capacity, U.S.D.A., 771.

Pastures—Continued.

old, improvement, 437.

(See also Grass, Grassland, and Meadows.)

Pavement, wood block, relative wear, 780.

Pavements, impact tests, U.S.D.A., 186, 285.

(See also Concrete and Roads.)

Pea—

and barley silage. (See Silage.)

blossoms, color factors in, 433.

bran, analyses, Mich., 168.

mildew, notes, 741.

root rot, notes, 543; Del., 646.

seed, vitamin A content, 357.

Peach—

anthracnose, varietal resistance, 243.

blossom blight, 543.

borer, control, 156; N.J., 156; U.S.D.A., 156.

borer, mechanical protectors for, N.J., 556.

borer, studies, S.C., 747.

brown rot, control, Mich., 552.

buds, dormancy and winterkilling, 338.

crowngall, 543.

disease control, Ga., 533.

June drop, Del., 651.

leaf curl, 453, 646, 741, 844.

little disease, studies, Del., 646.

mildew, notes, 741.

moth, oriental, life history, Va., 659.

moth, oriental, studies, 750.

root borer, control, 750.

rot, notes, 447.

scab, 453.

stocks, longevity, Tex., 335.

thrips in California, 853.

yellow, studies, Del., 646.

Peach-almond hybrid, 841.

Peaches—

composition, changes in, Del., 642.

cover crops and fertilizer treatments, 444.

dried, energy value, 859.

odorous constituents, 202.

propagation, N.J., 536.

variety tests, S.C., 733.

winter injury, 447.

Peacock-hen hybrids, 575.

Peanut—

Association, Southeastern, regulations, 834.

cake, cracked, analyses, Tex., 675.

feed, analyses, 871.

hay with nuts, analyses, Tex., 675.

leaf spot, 648.

meal, analyses, Tex., 675.

oil, analyses, 109.

oil, production, 636.

Peanuts—

breeding experiments, S.C., 725.

cost of production, 590.

improvement by selection, 830.

notes Guam, 726.

variety tests, 436.

Pear—

blight, Mont., 651.

blossoms, thinning, 140.

leaf-curling midge, 460.

pollen, viability and potency, 39.

psylla, control, N.J., 555; N.Y.State, 796.

shoot growth rate, nature of, 127.

spread, manufacture, 755.

Pears—

breeding experiments, 39.

dried, energy values, 859.

maturity, apparatus for testing, Oreg., 641.

pruning, Caldwell method, 736.

spraying experiments, 646.

stock and scion studies, 841.

winter injury, 139.

winter study, 839.

Peas—

anthocyanin formation in blossoms, 433.

as affected by sulphur, Wash., 427.

Ascochyta on, 241.

barium in, Colo., 29.

black eye in, studies, 125.

canned, bacterial flora, 859.

canned, standards for, 15.

canning, inoculation tests, 19.

canning studies, U.S.D.A., 664.

cost of production, Miss., 590.

effect on following crop, 336.

heredity of rogue types, 37.

hogging-down experiments, Idaho, 171.

hybridization experiments, 430.

lithium in, Colo., 29.

notes, Guam, 726.

variety tests, 131, 839; Mont., 327.

vitamin A content, 357.

vitamin A content, relation to pigments, 257.

Peat—

bog, drained, soil shrinkage in, Wis., 186.

bog, pump drainage of, Wis., 185.

deposits, evidence of climatic changes, 317.

exhibit in Philadelphia, 219.

fertilizer experiments, 216.

fertilizing value, R.I., 213.

litter, nitrogenous, fertilizing value, 319.

marshes, tiling, 381.

nitrogen, acid, amid fraction of, 21.

preparations and use in Ireland, 584.

soils, improvement, 216.

(See also Moor soils.)

Pecan—

culture in Florida, 41.

rosette, studies, 653.

Pectase, effect on action of pectin, 110.

Pectin—

behavior toward alkalis and pectase, 110.

studies, 207.

Pectinase produced by *Rhizopus* spp., 325.

- Pectinophora gossypiella*. (See Cotton boll-worm, pink.)
 Pediculus. (See Lice.)
 Pedigrees, analysis, 268.
 (*Pegomya*) *Phorbia cepetorum*. (See Onion maggot.)
Pegomyia brassicae. (See Cabbage maggot.)
Pelicularia koleroga, notes, 647.
 Pellagra—
 and acrodynia, 261.
 studies, 64, 762.
Penicillium—
 chrysogenum, respiration, effect of pH value, 127.
 spp. in corn meal, 356.
 spp., notes, 447, 653.
Penicillium in sugar solutions, studies, 417.
 Pennsylvania—
 College, notes, 97, 197, 700.
 Station, notes, 97, 197, 397, 700.
 Pentosan content, relation to hardness of plants, 443.
 Pentosans, determination, 112.
 Pentose sugars, reduction and dehydration, 26.
 Pentoses, determination, 112.
 Pepper blight, relation to soil moisture, N.Mex., 346.
 Peppers—
 hardening process in, 827.
 lime requirements, R.I., 233.
 pimiento and bell, production, Ga., 538.
 (See also Chilies.)
 Peptone, effect on indol formation by *Bacillus coli*, 180.
 Perchloric acid, use in nitrogen determination, 615.
 Perfumes, artificial, chemistry of, 308.
Peridermium—
 harknessii, notes, 150.
 strobi. (See White pine blister rust.)
Peridroma saucia. (See Cutworm, variegated.)
Perilitus eleodis, parasitism by, 355.
 Perilla, seeding tests, Conn.State, 332.
 Permanganate-oxalate titrations, effect of filter paper, 805.
 Permeability—
 changes produced in, Del., 628.
 of citrus leaves, 432.
 of plant cells, effect of anions, 126.
 Peronospora—
 distribution in Switzerland, 545.
 outbreaks, signaling, 849.
Peronospora—
 effusa, notes, 45.
 hyoseyami, notes, 651.
 schachtii on sugar beets, 450.
 schleideni, perennial mycelium in, 847.
 schleideniana, notes, 145.
Pestalozzia scirrofaciens n.sp., description, 150.
Pestalozzia on ferns, 647.
 Pfeiffer's bacillus, growth studies, 78, 79, 80.
Phaenacantha australica on sugar cane, 246.
Phaneroptera n.g. and n.sp., description, 559.
 Pharmacopoeia of United States, 178.
 Phenol, effect on rabic virus, 278.
 Phenology, studies in, 434.
 Phenylalanin, effect on starch hydrolysis, 707.
 Phenylhydrazin, method of estimating, 112.
Philænus lineatus, life cycle, Conn.State, 154.
 Philippine College of Agriculture, notes, 398.
Phlocosinus enixus n.sp., description, Miss., 462.
 Phlorizin, oxidase acting on, 825.
Phlox drummondii, synthesis of full coloration, 723.
Pholiota adiposa on blazed trees, 151.
 Phoma—
 betæ on sugar beets, 450.
 musæ, notes, Hawaii, 647.
 oleracea, notes, 543.
 sp., notes, 454.
Phomopsis—
 citri, notes, 453.
 pseudotsugæ n.sp. on Douglas fir, 244.
 Phormium, determination of flexibility, 230.
Phorocera meracanthæ n.sp., description, 57.
 Phosphate—
 availability, effect of liming, 24.
 fertilizing value on peat soil, 216.
 ion relation to rickets, 471.
 rock, availability as affected by ammonium sulphate, Ohio, 429.
 rock, availability as affected by green manure, 320.
 rock, effect of nitrification and sulfonation, Ohio, 429.
 rock, fertilizing value. (See Phosphates, comparison.)
 rock, finely ground, use, 21.
 rock, production and export, 219.
 rock, production and sale, 430.
 rock, solvent effect of organic matter, 21.
 Phosphates—
 briquetting, 718.
 comparison, 315, 319, 821; Mo., 315; S.C., 717.
 fertilizing value, 216, 817.
 for pasture improvement, 624.
 in soil, solubility, 320.
 manufacture, acid decomposition process, 718.
 soluble, behavior of plants toward, 627.
 soluble, in soils test, correction, 310.
 soluble, retention in soils, 121.
 (See also Superphosphate.)
 Phosphatic slag—
 as affected by fluorspar, 22.
 fertilizing value, 23.
 (See also Phosphates, comparison.)
 for pasture improvement, 624, 625.
 solubility as affected by lime, 23.
 Phosphatids, structure and significance, 11

Phosphoric acid—

- absorption by plants, 627.
- determination, 415.
- distribution in blood of children, 259.
- extracts, enriching, 718.
- fertilization, 424.
- fertilization of moor soil, 215.
- fertilization of soils, effect, 821.
- fertilization, results, 219, 220.
- in humus soils, nature, 715.
- manufacture, 718.
- need and use by plants, 224.

Phosphoric oxid, solubility in mixed fertilizers, 520.

Phosphorus—

- content of serum, relation to rickets, 165.
- deficient diet, effect, 472, 473.
- effect on nitrogen content of legumes, 120.
- importance in nutrition, 259.
- inorganic, in blood plasma, 506.
- metabolism, relation to milk fat origin, 878.
- salts, effect on quality of potatoes, 441.

Phothora vastatrix, notes, 647.

Photosynthesis—

- and respiration, interrelation, 25.
- in fresh-water algae, 824.
- in marine algae, 825.

Photosynthetic efficiency and light intensity, 29.

Phragmidium—

- gedeanum*, notes, 829.
- imitans*, notes, 143.

Phthorophloeus n.spp., description, Miss., 461.

Phyllachora sacchari, notes, 45.

Phyllostoma germanica, biology and control, 53.

Phyllosticta—

- congesta*, description, 348.
- solanicola*, notes, 451.
- solitaria*, notes, 543.
- solitaria*, studies, 148.
- sp., notes, 647.

Phylloxera, control, 51.

Phylloxera-resistant stocks, Calif., 540.

Physiology—

- of domestic animals, treatise, 681.
- principles, treatise, 255.

Physocephalus sexalatus, notes, La., 281.

Phytalus smithi—

- campaign against, 559.
- on sugar cane, 534.

Phytonomus murinus. (See Alfalfa leaf-weevil.)

Phytonomus posticus, parasite of, identity, 857.

Phytopathological service in Netherlands, 741.

Phytophthora—

- cryptogea*, notes, 54.
- faberi*, notes, 845.
- infestans* on cucumber, 449.
- infestans* on tomato, 451.

(See also Potato blight, late.)

Phytophthora—Continued.

- spp., notes, 44, 447, 454, 745.
- terrestria*, distribution, 149.

Pickles, cucumber, bacteriology, 502.

Picric acid—

- as an agricultural explosive, 887.
- effect on plants, 544.

Pigeon pea, culture and use, Hawaii, 440.

Pigeons, flying homer, treatise, 173.

Pigmentation—

- effect of colored light, 325.
- in animal fats, relation to vitamin A, 61.
- in peas, relation to vitamin A, 257.
- (See also Anthocyanin and Color inheritance.)

Pigments, identification in brown-husked corn, 125.

Pigs—

- acid rations for, effect, Iowa, 363.
- Berkshire, description, 768.
- crossbred, errors in feeding experiments, 677.
- distribution in South America, 269.
- feeding experiments, 271; Calif., 576; Guam, 763; Iowa, 363; Mich., 478; Mo., 363; Mont., 364; N.Mex., 365; Tex., 365; U.S.D.A., 531, 767.
- (See also Sows, brood.)
- glands, hemicellulose in, 69.
- hogging-down corn and soy beans, Mo., 364.
- hogging-down experiments, Ky., 874.
- hogging-down peas, Idaho, 171.
- inheritance in, 268, 766.
- mineral mixtures for, Iowa, 73.
- on forage, amount of grain for, Ohio, 368.
- pasturing experiments, Iowa, 363; Mont., 364; U.S.D.A., 531, 767, 874.
- raising, equipment for, Iowa, 386.
- raising in China, 573.
- value of skim-milk powder for, 874.
- vitamin-rich rations for, effects, Iowa, 362.
- (See also Sows and Swine.)

Pine—

- beetle, black, notes, 558.
- Bishop, notes, 664.
- blister rust. (See White pine blister rust.)
- forests of Ontario, planting plan, 541.
- oil and pine distillate product emulsions, U.S.D.A., 178.
- seedlings, western yellow, soil type and root form, 446.
- seeds, Scotch, germination, 142.
- shoot beetle, notes, 558.
- weevils, notes, 558.
- western yellow, importance and distribution, U.S.D.A., 341.
- western yellow, waste, distillation, U.S.D.A., 312.
- yellow, reproduction, 644.
- (See also White pine.)

Pineal gland, embryonic development in the ostrich, 573.

Pineapple fungus, summary, 348.

Pineapples—

- culture experiments, Hawaii, 643.
- culture in Florida, U.S.D.A., 340.
- fertilizer experiments, Guam, 734.
- propagation tests, Guam, 734.

Pines—

- natural infection, distance of spread, 150.
- of South Australia, properties, 382.

Pink bollworm. (*See* Cotton bollworm, pink.)

Pipe—

- corrugated-iron, coefficient of roughness, 888.
- horizontal, stress coefficients for, 490.

Piricularia oryzae, notes, 448.

Piroplasma tarandi rhangferis, notes, 685.

Piroplasmosis—

- bovine, in Great Britain, 484.
- in Indo-China, 181.
- of reindeers, 685.
- summary, 580.

Pisé de terre farm buildings, specifications, 386.

Pissodes strobi, notes, 254.

Pityogenes meridianus n.sp., description, Miss., 462.

Pityophthorus n.spp., description, Miss., 462.

Plant—

- breeding, handbook, 829.
- breeding experiments. (*See* Corn, Cotton, Wheat, etc.)
- (*See also* Heredity, Hybridization, and specific plants.)

cancer, studies, 49.

cells—

- capillary processes in, 432.
- mitochondria in, 29, 824.
- (*See also* Cells.)

chromosomes. (*See* Chromosomes.)

color, modification, 224.

colors, characters and behavior, 223.

culture, fundamentals, treatise, 720.

disease survey, S.C., 741.

disease survey of Ontario, 844.

diseases—

- and pests, 448.
- and pests, handbook, Calif., 238.
- biochemistry, 553.
- in Dutch East Indies, 343.
- in England, 741.
- in France, 44.
- in India, 742.
- in Indo-China, 741.
- in Morocco, 647.
- in Netherlands, 741.
- in Ontario, 43.
- in Philippines, 43, 845.
- in Poland, 742.
- in small gardens, control, 742.
- nonparasitic, treatise, 843.
- treatise, 238.

(*See also* Fungi and different host plants.)

Plant—Continued.

distribution, relation to hydrogen-ion concentration of soil, 432, 525.

foods, 224.

growth—

- and soil conditions, treatise, 809.
- as affected by dicyandiamid, 625.
- as affected by electricity, Ky., 830.
- as affected by formalin in conserved liquid manure, 518.
- as affected by wind, 827.
- effect of cold in stimulating, 225.
- effect of colored light, 325.
- effect of reaction of nutrient solution, N.J., 525.
- effect on oxidizing flora of soil, N.J., 526.
- effect on sedimentation period, 517.
- efficiency index, significance, 523.
- function of calcium in, 433.
- quantitative analysis, methods, 523.

rate, nature of, 127.

lice in apple orchards, N.Y.State, 351.

life in New Zealand, treatise, 222.

movement, treatise, 528.

movements, developmental, 224.

oil, therapeutic value, 568.

pathology, development, 739.

pest control legislation in Florida, 457.

pest law, inspection work under, 152.

physiology, treatise, 126.

pigmentation. (*See* Pigmentation.)

production quadrats, 27.

propagation, R.I., 227.

protection, organization for, 447.

protection, practical, 447.

succession, topographic relief as factor, 432.

tissues, dry *v.* fresh, effect on calcium assimilation, 566.

tissues, formation of vitamin A in, 356.

varieties, agronomic placement, 829.

Plants—

alkaloids in, function, 324.

as affected by ammonium sulphate, Mass., 21.

assimilation of nutrients, 622.

barium in, Colo., 28.

behavior of organic substances in, 324.

carbohydrate production, biochemistry, 522.

carbon dioxid nutrition and manure, 424.

classifications, 522.

cryptogamic parasites of, 448.

desert. (*See* Desert.)

double symbiosis in, 722.

effect of shading, N.H., 138.

effect of sterilizing agents, 544.

evolution of, 524.

excretion in, 224.

fiber. (*See* Fibers.)

flowering, inheritance of germinal peculiarities, 27.

Plants—Continued.

- flowering, new, from Guatemala and Honduras, 721.
- gas injury to, 128.
- genetic nature of winter and spring varieties, 632.
- green, effect on oxidizing flora of soil, N.J., 513.
- growing in the dark, Del., 628.
- hardiness, relation to pentosan content, 443.
- hydrocyanic acid formation in, 630.
- hydrocyanic acid injury to, 641.
- imports, U.S.D.A., 29.
- in new habitats, studies, 26.
- injury and recovery, 128.
- land, algal ancestry, 524.
- light in, physiology, 224.
- lithium in, Colo., 28.
- medicinal. (*See* Drug plants.)
- modifications under varying conditions, 721.
- nutrition in calcareous soils, 321.
- organic nutrition, 224.
- pentosan content, relation to hardiness, 443.
- perennial, chlorophyll-bearing organs, 27.
- permeability. (*See* Permeability.)
- photosynthesis. (*See* Photosynthesis.)
- poisonous. (*See* Live stock poisoning and specific plants.)
- pollination. (*See* Pollination.)
- regeneration, quantitative laws in, 128.
- respiration. (*See* Respiration.)
- salt requirements, 26.
- strontium in, Colo., 28.
- suberin and cutin in, 631.
- supplemental list from southeastern Alaska, 222.)
- titanium in, Colo., 28.
- transpiration. (*See* Transpiration.)
- utilization of rock phosphate, 21.
- variation. (*See* Variation.)

Plasmiodiophora—

- brassicæ*. (*See* Cabbage clubroot.)
- vascularum* n.sp., description, 551.

Plastids, origin, 722.

Pleospora—

- pomorum*, n.sp., description, 243.
- trichostoma*, notes, 545.

Pleuropneumonia, contagious—

- of cattle, diagnosis, 582, 883.
- of horse, and grippe, comparison, 278.

Pleurotropis epigonus, distribution, 464.*Placaederus obesus*, notes, 51.Plowing, tractor. (*See* Tractor plowing.)

Plows—

- design and operation, 100.
- tractor, tests, 87.

Pork—

- aphids, control, 855.
- blotch, 348.
- brown rot, control, Mich., 552.
- brown rot, effect on fruit, 553.
- drought spot, notes, 452.

Plum—Continued.

- webspinning sawfly, studies, 58.
- withertip, notes, 741.

Plums—

- breeding experiments, 39.
- culture in Canada, 234.
- self-fertility and sterility in, 39.
- storage studies, 338.
- variety tests, S.C., 733.
- winter study, 839.

Pneumococcus protective substances in chicken serum, 775.*Pneumonia*, contagious, of goats, 883.

(*See also* Pleuropneumonia.)

Poison bait for grasshoppers, 53, 657.

Poisonous plants. (*See* Live stock poisoning, and specific plants.)

Poisons, sensitiveness of avitaminous animals to, 470.

Polarimetry, new sodium lamp for, 111.

Pollen—

- age, effect on hybrids, 721.
- longevity, studies, N.Y.Cornell, 828.

Pollination—

- apparatus for sugar cane, 135.
- in orchards, 840.
- rôle of bumblebees in, 840.
- studies, 39.
- (*See also* specific plants.)

Polyneuritis—

- avian, alcoholic extracts of yeast for, 569.
- avian, nature of paralysis, 669.
- avian, production by synthetic ration, 570.
- avian, studies, 668, 669.
- decreased activity of smooth muscle in, 470.
- (*See also* Vitamin B.)

Polyopeus n.g. and n.spp., description, 243.*Polyporus*—

- spp., notes, 741.
- tsugæ*, notes, 348.

Pomegranate root bark, taenical value, 687.

Ponies, pasturing experiments, Guam, 763.

Popcorn, prehistoric, 467.

Popillia japonica—

- control, 661.
- grubs, treatment for, 251, 252.

Poplar leafhopper, 852.

Poplars, *Cytospora chrysosperma* on, 850.

Poppies, wild, destruction in cereals, 138.

Poppy—

- disease survey in India, 544.
- opium, flower color in relation to morphine content, 125.
- seed oil, production, 636.

Population, urban and rural, in Australia, 695.

Pork—

- international trade, 675.
- preparation on the farm, 808.
- production. (*See* Pigs.)
- soft, production, Tex., 365.

Parasagrotis orthogonia—

control, 153.

parasites of, 247.

summary, 352.

Porthetria dispar. (See Gipsy moth.)

Porto Rico Insular Station, notes, 796.

Potash—

Alsatian, 522.

American source and value, 626.

deposits in west Texas, 719.

fertilization, 424.

fertilization of moor soils, 215.

fertilizers, sources, S.C., 717.

fertilizing value, Mass., 19.

fertilizing value on peat soil, 216.

from greensand, 719.

from kelp, 23.

need and use by plants, 224.

recovery from cement kilns, 220.

salts, action on acid soil, 520.

salts, effect on soil moisture, 627.

shales of Illinois, 626.

Trena, effect on crops, S.C., 717.

Potassium—

ammonium nitrate, composition and action, 820.

availability, effect of liming, 24.

determination in blood, 416.

determination in feces, 417.

determination in soil, use of silica crucibles, 805.

determination in urine, 417.

effect on nitrogen content of legumes, 120.

fertilizers, effect on quality of potatoes, 440.

hydroxid solution, alcoholic. preparation, 614.

iodid for goiter and hairlessness, Mont., 374.

magnesium sulphate, value for potatoes, 425.

phosphate, antirachitic value, 165, 473.

removal from soil, N.Y.Cornell, 210.

sulphate, value for potatoes, 425.

thiocyanate, effect on plants, 544.

Potassium-bearing shale for soil improvement, 626.

Potato—

black scab, 449, 743.

black scab in Netherlands, 744.

blackleg, 741, 847; Can., 145.

blight, early, 847.

blight, late, 543, 649, 847; Can., 145; Mass., 43.

blight resistant varieties, Hawaii, 633.

canker, 847.

curl, notes, 741.

demonstrations in Ontario, 242.

disease in Holland, 741.

disease survey in India, 544.

diseases, Can., 145.

diseases, control, in England, 241.

diseases, effect of heat on seed, 848.

diseases in Canada, 847.

diseases, studies, 844; N.J., 548.

Potato—Continued.

filosity, cause, 744.

Fusaria rots, effect of temperature and humidity, 146.

Fusarium disease, Mont., 343.

Fusarium diseases, 847.

juice extracted with acids, antiscorbutic value, 359.

leaf curl, cause and control, 242.

leaf roll, 847; Can., 145.

leaf roll as affected by climate, 242.

leaf roll, control, 450.

leaf roll, studies, 44, 147.

leafhopper, control, 246; Ohio, 749; U.S.D.A., 153.

leafhopper, curly dock as host, Iowa, 349.

mosaic, 847; Can., 145.

mosaic in Great Britain, 848.

mosaic, relation to running out, Minn., 346.

proteins, supplementary value, 161.

Rhizoctonia, control, 844.

rot due to cold, 241.

scab, notes, 44, 741, 847.

scab, studies, 450.

scab, sulphur for, 649.

scab, treatment, 549; N.J., 549.

seedlings, description, 834.

spindling sprout, 744.

tipburn, artificial production, 549.

tipburn, control, Ohio, 749.

tipburn, etiology, 744.

tipburn, notes, 51, 847.

tipburn, relation to leafhopper, Iowa, 349.

tuber rot under irrigation, 146.

wart disease, distribution, 242.

wart disease, European, 242.

wart disease, history and distribution, 550.

wart disease, immunity, 550.

wart disease in Europe, 650.

wart disease in Netherlands, 450.

wart disease in Pennsylvania, 650.

wart resistant varieties, 146.

wilt, notes, 847.

Potatoes—

after alfalfa, fertilizer experiments, N.J., 590.

as affected by borax, 123; Conn.State, 322.

breeding experiments, 533, 633.

commercial utilization, 15.

cooperative marketing, Minn., 290.

copper absorption by, 324.

cost of production, N.J., 590.

culture experiments, 131, 533.

culture in England, 636.

culture on peat soil, 216.

culture, scientific research in, 636.

culture, storage, and marketing in British Columbia, 231.

degeneration in, 126, 548.

deterioration, R.I., 227.

effect on following crop, 336.

Potatoes—Continued.

- fertilizer experiments, 131, 227, 425, 533, 633; S.C., 725.
- frost injury, 241.
- grades of North Dakota, 134.
- growth and accumulation of reserve material, 25.
- hot composted manure for, 818.
- hybridization studies, 834, 835.
- inheritance of abnormal haulm type, 126.
- liming experiments, 131.
- maturity trials, 835.
- quality, effect of fertilizers, 440.
- rotation experiments, 131, 819; U.S. D.A., 725.
- salt requirements, N.J., 526.
- seed certification, 33.
- seed, comparison of stem with seed end, 231.
- seed, for Connecticut, Conn. Storrs, 835.
- seed, hot formaldehyde treatment, Iowa, 342.
- seed, maturity and size, N.J., 530.
- seed, size, and source, 227.
- seed, tests, Mo., 332.
- seed, treatment, 650; Iowa, 342.
- seeding experiments, 533, 633; Mont., 327.
- spacing and seeding experiments, 131.
- spraying experiments, 241; N.J., 548; Ohio, 749.
- storage tests, 533.
- sun-dried, vitamin content, 359.
- synonymous varieties, 730.
- time of applying manure, 531.
- varieties, R.I., 226.
- varieties in Germany, 231.
- variety tests, 131, 227, 531, 533, 663.
- wild, habitat and growth, 32.
- yield as affected by time of harvest, 231.
- yields in New Jersey, 225.
- yields in relation to missing hills, Mont., 327.

Poultry—

- breeding, treatise, 272.
- colony breeding, N.J., 574.
- diseases, distribution and prevalence, N.J., 534.
- diseases, treatise, 276.
- (See also specific diseases.)
- feeder and watering stand, Ohio, 782.
- feeding experiments, 770; Calif., 576; Iowa, 363; Mo., 370; U.S.D.A., 531.
- (See also Chicks, Hens, laying, and Pullets.)
- feeds, analyses, Can., 168; Mich., 168.
- for exhibition, standard, 875.
- genetic studies, 272.
- houses, construction, Mont., 693.
- houses, equipment, N.J., 189.
- houses for Kentucky, 385.
- houses for Missouri, 385.
- houses for Ohio, 386.
- houses, plans, Wis., 288.

Poultry—Continued.

- husbandry, textbook, 95.
- improvement, Missouri plan, 72.
- industry in Netherlands, 875.
- keeping for boys and girls, 598.
- keeping, handbook, 768.
- keeping in city, 273.
- keeping in Porto Rico, P.R., 370.
- linkage in, 769.
- mating, methods, N.J., 369.
- plant, sanitary practices, N.J., 678.
- purebred, record of performance, 770.
- raising in China, 573.
- sex-linked inheritance in, Mo., 370.
- system of pedigree work, 876.
- winter handling, Wash., 297.
- yard sanitation, Wash., 297.
- yards, green crops in, values, N.J., 574.
- (See also Chickens, Ducks, Fowls, Geese, and Hens.)
- Prairies of Canada, tree planting on, 843.
- Precipitation. (See Rainfall and Snow.)
- Pressure cooker, use in the home, 257.
- Preventive medicine and hygiene, treatise, 859.
- Prickly pear. (See Cactus.)
- Prionoxystus robiniae*, notes, 750.
- Privies, types, relation to intestinal infections, 588.
- Prodenia litura* on rice, 458.
- Propagating frame, description, 640.
- Prophylaxis of animal diseases, treatise, 579.
- Prosperity, national, factors affecting, 590.
- Protea cynaroides*, bacteriolytic action in, 44.
- Protein—
 - animal, value for laying hens, 875; Ky., 875.
 - deficiency and pellagra, 762.
 - excess, effect on milk secretion, 65.
 - formation from urea by ruminants, 67, 68.
 - metabolism, physiology, 563.
 - requirements for heifers, Mo., 371.
 - requirements of children, 756.
 - requirements of growing calves, 764.
 - source for egg production, Ky., 875.
 - values, supplementary, in foods, 161.
- Proteins—
 - digestibility, studies, 163.
 - hydrolysis, separation of amino acids, from, 802.
 - of alfalfa plant, 801.
 - of milk, anaphylaxis reactions, 9.
 - qualitative differences in relation to nutrition, 255.
 - soluble, from soy beans, preparation, 356.
- Protoplasm, components and colloidal behavior, 25.
- Protozoology, treatise, 78.
- Protura—
 - Nearctic species, notes, 255.
 - new genera and species, 465.

Prune—

- aphids, control, 855.
- butter, manufacture, 755.
- drought spot, notes, 452.
- root borer, control, 750.

Prunes, dried, energy value, 859.

Pruning, long and old style, 640.

(See also specific crops.)

Prussic acid—

- in forage, poisonous to live stock, 484.
- in jowar, 722.

Pseninae, new species, 58.

Pseudomonas—

- citri*. (See Citrus canker.)
- fluorescens* in decomposing salmon, 754.
- juglandis*, notes, 144.
- pyocyaneus* in swine pneumonia, 83.
- radicicola*. (See *Bacillus radicicola*.)
- spp., on sugar beets, 450.

Pseudopeziza ribis—

- control, 844.
- notes, 243.

Pseudopityophthorus gracilus n.sp., description, Miss., 462.

Pseudothysanoses n.g., description, Miss., 461.

Psichacra spp., parasitism by, 158.

Psylla pyri. (See Pear psylla.)

Pterygophorus analis larvae fatal to cattle, 776.

Puccinia—

- antirrhini*, control, Mass., 653.
- graminis avenae*, notes, 545.
- graminis*, relation of grasses to, 448.
- graminis tritici* germination, effect of citric acid, 846.
- kuehnii*, notes, 45.
- pruni* on peach, 845.
- prunispinosae*, notes, 453.
- spp. on cereals, 239, 240.
- spp., temperature of spore germination, N.H., 343.
- triticea*, aecial stage, 144.
- triticea*, notes, 845.

Pullets—

- development, effect of time of hatching, N.Mex., 370.
- early v. late-maturing, Ohio, 768.
- fall and winter care, Mich., 598.
- feeding experiments, Ind., 574.
- (See also Chickens and Hens.)

Pulley tests, summary, 782.

Pulleys, standard belt, formulas, 287.

Pulvinaria innumerabilis, symbiotic fungus in, 246.

Purdue University, notes, 195, 499, 794, 899.

Purin metabolism, endogenous, effect of diet, 757.

Purpura hemorrhagica, treatment for, 686.

Pyrausta ainsliei, life history, 660.

Pyrausta nubilalis. (See Corn borer, European.)

Pyrethrum, alcoholic extract, insecticidal value, 748.

Pyrheliometers, standardization, 418.

Pythiacystis citrophthora—

- distribution, 149.
- notes, 651.

Pythium—

- butleri*, notes, 347.
- debaryanum*, notes, 45, 847.
- debaryanum* on sugar beets, 450.
- debaryanum* on tomato, 451.

Quebracho bark ashes, fertilizing value, 823.

Quercetin, occurrence in brown-husked corn, 125.

Quinol, color reaction, 668.

Rabbit brush, poisonous to sheep, 396.

Rabbits—

- diseases of, treatise, 276.
- raising, Wash., 498.
- snowshoe, injurious to conifers, 447.
- zinc in, variation, 667.

Rabic virus, desiccated, preparation, 181.

Rabies—

- control in Massachusetts, 681.
- immunization method, 278.
- notes, 773.
- occurrence in Great Britain, 178.

"Radio" manure, fertilizing value, 221.

Raffinose and sucrose mixtures, analysis, 205.

Ragi, *Piricularia* on, 448.

Ragi, root parasites, 343.

Railroad rates—

- effect on fertilizer industry, 522.
- on agricultural products in France, 694.

Rain—

- analyses, U.S.D.A., 116.
- water, dead leaves in, effect on grain germination, 813.
- water, sulphur in, 16.

Rainfall—

- and run-off studies, 380.
- effect of Great Lakes, U.S.D.A., 619.
- effect on oak growth rings, Mo., 16.
- maps of Latin America, U.S.D.A., 619.
- of Latin America, U.S.D.A., 619.
- records at Rothamsted, 314.
- relation to sunspots, 209.
- seasonal, U.S.D.A., 16.

Ramie, determination of flexibility, 230.

Ramularia arcola, notes, 845.

Ranch cost accounting, 893.

Rape—

- effect on soil reaction, 211.
- feeding value, Iowa, 363; Mont., 364.
- oil, production, 636.
- oil, therapeutic value, 568.
- sulphids on, 51.

Raspberries—

- breeding experiments, 39.
- culture in Canada, 234.
- growing in Massachusetts, 842.
- storage studies, 338.
- variety tests, 839.

Raspberry—

- anthracnose, notes, 143.
- cane blight, notes, 143.
- crown gall, 543.
- juice, desiccated, antiscorbutic value, 359.

Raspberry—Continued.

shoots, hardiness, relation to pentosan content, 443.

yellow rust, notes, 143.

Raspberry-dewberry hybrid, Tex., 335.

Rats—

effect of lactation on sexual cycle, 871.

eradication in Great Britain, 455.

growth and weight as affected by thirst, 264.

hermaphroditism in, 265.

Moniliformis species in Tex., 49.

resistance to consecutive injections of strychnin, 655.

susceptibility to strychnin, 655.

(See also Rodents.)

Ravenelia erythrinae n.sp., description, 829.

Ravens in Normandy, 852.

Reagents, organic chemical, preparation, 414.

Reclamation—

projects, U.S.D.A., 724, 793.

Service, report, 886.

Recurvaria nanella, notes, 749.

Red—

dog flour. (See Flour, red dog.)

gum trees, tapping methods, 341.

lead, use in paint, treatise, 688.

mite, European, in Connecticut, 753.

soils, origin, 621.

spider mites, control, 160, 662.

spider mites, new Nearctic, 161.

spider mites, studies, S.C., 747.

spider on avocado, U.S.D.A., 752.

Reductase test for milk, limitations, 75.

Redwood—

identity, 843.

second-growth, volume tables, Calif., 342.

Refractometer for valuation of sugar beet seed, 807.

Relapsing fever, transmission by ticks, 682.

Remedies, new and nonofficial, 880.

Rennet manufacture, 771.

Rennin, action on casein types, 261.

Research, agricultural. (See Agricultural research.)

Respiration—

and photosynthesis, interrelation, 25.

apparatus, 166.

apparatus, Benedict portable, criticisms of, 260.

in apples, 337.

in sprouting barley, 224.

rate of leaves, 25.

studies, 127.

Respiratory quotient, uncertainty, 70.

Rhabdoenemis obscurus, Guam, 748.

Rhadinoceraea micans, oviposition and habits, 857.

Rhagoletis suavis, life history, U.S.D.A., 249.

Rhenania phosphate, fertilizing value, 820.

Rheosporangium aphanodermatus, notes 347.

Rhienopeltella eucalypti n.sp., description, 857.

Rhinoceros beetles—

biology, 250.

studies, 559.

Rhizoctonia in Porto Rico, 545.

***Rhizoctonia solani*—**

notes, 447, 451, 544.

physiological specialization, 325.

sp., notes, 45, 846.

***Rhizopus*—**

nigricans in corn meal, 356.

nigricans, notes, 447, 647, 846, 847.

spp., pectinase produced by, 325.

Rhode Island—

College and Station, notes, 198.

Station, report, 297.

Rhododendron root rot, 150.

Ribes. (See Currants and Gooseberries.)

Rice—

blast, notes, 448.

borer, control, 458.

bran, analyses, Mich., 168; Texas, 675.

breeding, 134, 634.

bug, life history and control, 458.

bug, notes, Guam, 748.

cost of production, 89.

cracked, analyses, Tex., 675.

culture experiments, 131, 226, 227, 436, 437.

culture in Colombia, 391.

culture in India, 231.

culture, methods, Hawaii, 633.

disease survey in India, 544.

fertilizer experiments, 131, 227, 437,

634; Guam, 726; Tex., 328.

fields, decomposition of *Astragalus sinicus* in, 715.

flour, detection, 13.

Millers' Association, statistics, 441.

pests in Philippines, 457.

polish, analyses, Tex., 675.

production in Japan, 533.

production in Mexico, 33.

rotation experiments, 437.

seedlings, growth, 636.

selection experiments, 232.

starch manufacture from, 508.

stem borer, notes, 458.

variety tests, 131, 227, 437, 634.

wild, of India, classification, 33.

Rickets—

and vitamin A deficient diet, 165.

cure by sunlight, 165.

development, determining factor, 868.

dietic production and prevention, 165.

diffusible calcium of blood serum in, 203.

etiology, 360, 869.

experimental, studies, 471, 472, 473, 568.

prevention by mercury vapor quartz lamp, 869.

relation to calcium and phosphorus in serum, 165.

relation to vitamin A, 64.

seasonal variation, 164.

studies, 669.

Rinderpest—

- hyperimmunization, 682.
- hyperimmunization, anaphylaxis in, 881.
- immunization, 683.
- in Belgium, 773.
- in Belgium, control, 580.
- in West Africa and Poland, 580.
- inoculation method, 481.
- outbreak, control in Brazil, 683.
- serum, preparation in Poland, 279.
- serum, rapid production of, 376.
- studies, 82.
- summary, 279.

River—

- discharge measurements, improvement, 886.
- measurement. (*See* Stream flow measurements.)
- stages, daily, at gauge stations, U.S. D.A., 688.

Road—

- accident map of Maryland, U.S.D.A., 86.
- assessments, primary and secondary, 779.
- Bates experimental, 889.
- Bates experimental, report, U.S.D.A., 86.
- material standards, 285.
- materials of Indiana, tests, 381.
- materials, tolerance of sand in, U.S. D.A., 187.

Roads—

- administration in Maryland, 489.
- administration in Ontario, 585.
- brick, rolled base, U.S.D.A., 285.
- construction with army materials, U.S. D.A., 285.
- papers on, U.S.D.A., 86, 186, 285, 489.
- subgrade bearing power, testing, 87.
- tar treatment, specifications, 889.
- vertical curve formula, solution, U.S. D.A., 285.
- (*See also* Pavements.)

Robusta coffee as food substitute, 755.

Rock for road building. (*See* Road materials.)Rock phosphate. (*See* Phosphate.)

Rodents, new, from Oregon and Nevada, 456.

(*See also* Mice and Rats.)

Roentgen rays, effect on X-chromosomes, 673.

Roofing materials, Iowa, 383.

Root—

- adaptation to deficient soil aeration, 25.
- crops, culture experiments, 131.
- crops, culture in Sweden, 533.
- development and absorption, 29.
- development of grain as affected by fertilizers, 132.
- growth rate, effect of diminished oxygen supply, 25.
- maggots, control, N.H., 350.
- nodules. (*See* Nodule production.)
- pressure, mechanism, 431.

Roots—

- cell vacuoles in, origin, 823.
- contraction, 224.
- growing, liberation of organic matter, N.Y. Cornell, 323.
- metabolism, Mo., 323.

Rope, manila, tensile tests, 490.

Rose—

- bengal as bacterial stain, N.Y. State, 431.
- moss, origin, 842.
- rust, notes, 44.

Roselle, culture experiments, Guam, 733.

Rosewood, identity, 843.

Rosin varnish, value against borers, 252.

Rostronitschka nervincola n.g. and n.sp., description, 344.

Rotation—

- fertilizer experiments, 336; Hawaii, 623.
- of crops, R.I., 226.
- of crops and cultural methods, U.S. D.A., 130.
- of crops for dairy farm, Ohio, 394.
- of crops under irrigation, U.S.D.A., 724.
- of crops, value, 228.
- of crops, value of liming for, 426.

Rothamsted Experiment Station, notes, 797.

Roup, serum treatment for, 196.

Roup, vaccine for, Kans., 485.

Rubber—

- black stripe, 455.
- brown bast, 746, 747.
- brown bast resistant trees, 349.
- crowngall, behavior, 49.
- diseases, notes, 844.
- latex vessel system, relation to yield, 43.
- moldy rot, 455.
- plantations, thinning, 737.
- plantations, thinning, bark examination in, 143.
- plants, 42.
- preparation, analysis of chemicals for, 114.
- selection, 223.
- tapping methods, effect, 43.
- trees, budded, latex vessels in scion and stock, 42.
- trees, mother and daughter, correlation, 737.

Ruminants, parasites of, La., 281.

Run-off—

- and rainfall studies, 380.
- maximum, determination, 778.
- studies, Mo., 315.

Rural—

- community, description and mapping, 596.
- community organization, fundamentals, 895.
- community progress in Kansas, 496.
- community with highest score, W. Va., 191.
- credit. (*See* Agricultural credit.)
- economics in Argentina, 495.
- economics, teaching, 497.
- economics, value, 192.
- education as a profession, 93.

Rural—Continued.

- health, 89.
- homes relation to boys' and girls' clubs, 598.
- industries and wages in New South Wales, 494.
- industries around Oxford, 788.
- labor. (See Agricultural labor.)
- life in Cotton Belt, 189.
- organization, papers on, 89.
- primary groups, Wis., 894.
- property, valuation, 593.
- reconstruction, treatise, 596.
- sanitation, 782.
- schools. (See Schools, rural.)
- service, training for, 895.
- v. city health, 294.
- (See also Community and Country.)

Rust—

- fungi, distribution in Baltic regions, 239.
- mites, sulphur compounds for, 355.

Rusts, polemoniaceous, 344.

(See also Cereal, Wheat, etc.)

Rutabagas. (See Swedes.)

Rutgers College, notes, 197, 396, 795.

Rye—

- decomposition rate in soil, N.Y.Cornell, 212.
- effect of injury on development, 232.
- ergot, 322.
- ergot, control, 546.
- ergot on Manitoba wheat, 240.
- grass, breeding experiments, 633.
- green manuring experiments, N.J., 514.
- improvement by selection, 830.
- middlings, analyses, Can., 168; N.H., 675.
- rotation experiments, 819.
- systematic account, 322.
- treatment, 449.
- varieties, Mich., 633.
- varieties, new, description, 531.
- variety tests, 131, 531.
- yields, in Australia, 132.
- yields in New Jersey, 225.

Safflower oil uses, 502.

Sailors. (See Service men.)

Sainfoin clover sickness, notes, 741.

Saissetia olea. (See Black scale.)

Saliva, effect on bacterial content of stomach, 862.

Salmon, decomposing, bacteria in, 753.

Salt—

- balance of plants, effect of soil moisture, N. J., 525.
- effect on sugar beets, 719.
- ingestion, effect on chlorin content of blood, 174.
- penetration in fish, 664.
- proportions for young cotton, 629.
- requirements of potatoes, N.J., 526.
- requirements of seed plants, 26.
- rock, effect on plants, 732.

Salts—

- distribution in milk, 205.

Salts—Continued.

- in soil, toxicity in relation to osmotic pressure, 209.
- plant injury and recovery from, 128.
- soluble, variation in soils, 623.

San José scale—

- control, 350.
- control, failures in, Ill., 855.
- spraying for, Ark., 658.

Sand—

- excess in concrete mixtures, use, 487.
- filters, adsorption in, 892.
- tolerance in aggregates, U.S.D.A., 187.

Sanitation, rural. (See Rural sanitation.)

Sanninoidea—

- exitiosa*. (See Peach borer.)
- opalescens*, studies, 749.

Sapodilla tree, tumors on, 150.

Sarcophaga kellyi, parasitism by, 458.

Sardines, California, chemical study, 466.

Satiné, identity, 843.

Sauerkraut—

- bacteriology, 502.
- chemical composition, factors affecting, 502.

Sawan disease survey from India, 544.

Sawflies—

- larvae and adults, homologies, 464.
- North American, new species, 661.

Sawfly, web-spinning, 58.

Scabies. (See Mange.)

Scale insects—

- catalogue, 155.
- notes, 647.
- of Australia, catalogue, 559.

Scales, control, Mass., 50.

Schedius kuvanae, parasitism by, 457.*Schizoneura lanigera*. (See Apple aphid, woolly.)*Schoenobius punctellus* on rice, 458.

School—

- lunches, 792.
- of agronomy of Bogota, 392.
- of farm home management in Algiers, 898.
- social center, history and description, 596.
- teachers, rural, qualifications, 93.
- winter, for farmers, Wash., 297.

Schools—

- agricultural. (See Agricultural schools.)
- elementary, junior club activities, 897.
- Federal aid for, 193.
- junior high, household arts for, 597.
- one-teacher, instruction and facilities, 897.
- Rosenwald, in Virginia, 897.
- rural—
 - and teachers' houses in England, 94.
 - health education in, 194.
 - in New York State, 294.
 - of Delaware, 94.
 - of Maine, training supervisors, 93.
 - one-room, daily program, 94.

Schools—Continued.

rural—continued.

successful teaching in, 791.

supervision, 294, 896.

supervision, treatise, 392.

tests in, 94.

secondary, rural bias in, 791.

vocational. (See Vocational schools.)

Sclerospora sp., notes, 45.*Sclerotinia*—*fructigena*, notes, 453.*fructigena* on apricots, 47.*libertiana*, notes, 847, 849.*sclerotiorum*, notes, 543.*Sclerotium*—

sp., notes, 45.

stellatum n.sp., description, 243.*Scolytus*—*rugulosus*. (See Shot-hole borer.)

spp., and parasites on fruit trees, 253.

Scurvy—

blood picture in, 762.

changes in blood and vascular system in, 474.

cured by boiled milk diet, 360.

experimental, in rabbits, 474.

in guinea pigs, effect of unbalanced diet, 64.

in the World War, 261.

prevention for a polar expedition, 360.

Scyphophorus acupunctatus, notes, 58.

Seaweeds, vitamin A content, 357.

Secretin and vitamin B, differentiation, 761.

Secretin, effect in anemia, 760.

Seed—

cleaning process, new, 232.

control service in Denmark, 36.

inspection, Md., 233; Vt., 536.

inspection and certification, regulations, 36.

law in Scotland, 233.

marketing hints, U.S.D.A., 137.

production, 336.

products, transactions in, rules, 32.

regulations in Indiana, 536.

selection, 830.

separator, air-blast, modifications, 732.

testing in Scotland, 137.

testing station in Denmark, 37, 545.

treatment, electrical, 225.

treatment for barley leaf stripe, 545.

Seeds—

development, effect of endosperm, 772.

germinating, oxygen absorption, demonstration, 432.

germination, papers on, 731.

hemicellulose-splitting enzyme in, 69.

imports, U.S.D.A., 29.

labeling by seedsmen, 732.

new, germinability, 722.

oil. (See Oil seeds.)

vitality, 323.

weed. (See Weed seeds.)

winger, fall of, 41.

Septic tank, design, 492.

Septicemia, hemorrhagic, bacilli, heat-killed, immunizing value, 181.

Septogloeum arachidis, notes, 648.*Septoria*—*antirrhini*, notes, 654.*lycopersici*, control, Va. Truck, 336.*lycopersici*, notes, 46, 451, 745; Mass., 43.*pyricola*, notes, 543.*Septoria* species, tabulation, 431.

Sericulture. (See Silkworm.)

Serology and serum diagnosis, treatise, 276.

Serum—

calcium determination in, 203.

diagnosis, treatise, 276.

magnesium determination in, 203.

physiology, international catalogue, 222.

production, use of centrifuge for, 881.

Service men, disabled, agricultural training for, 193.

Sesame oil—

detection in olive oil, 710.

production, 636.

Settlers. (See Land settlement.)

Sewage—

disposal, 491.

disposal and sewerage, treatise, 891.

disposal on the farm, U.S.D.A., 891.

disposal plants, rural, 782.

fertilizer and manure, comparison, 319.

municipal, use for spray irrigation, 88.

soil, nitrifiability, 516.

soil pollution from, 589.

stockyard, treatment, 783.

treatment in Imhoff tanks, 783.

trickling filters, vegetable growths in, 492.

water pollution from, 589.

Sewer tunnels, tables for designing, 380.

Sewerage and sewage disposal, treatise, 891.

Sewing, directions in, 597.

Sex—

characters, formation, minimum of testicular substance for, 266.

neutralization from orchilytic serum injection, 266.

role in creatinuria of man, 757.

Shales, distribution in Appalachian Mountains, 487.

Sheep—

breeding experiments, 270.

digestion experiments, 67, 871; Mass., 476.

diseases. (See specific diseases.)

distribution in South America, 269.

feeding during drought, 72.

feeding experiments, 67, 68; Ind., 477; U.S.D.A., 531.

(See also, Ewes, breeding, and Lambs.)

for Western Washington, Wash., 498.

growth studies, 672.

in Rocky Mountains, losses, 883.

Sheep—Continued.

- inheritance in, 271.
 - international trade, 675.
 - Investigations, 766.
 - Karakul, breeding in Bokhara, treatise, 270.
 - Karakul, origin and management, 766.
 - lactating, calcium balance experiments, 74.
 - maggot flies and parasites, 661.
 - manure, nitrification, studies, 714.
 - nematode parasites of, 685.
 - poisoning. (*See Live stock poisoning, and specific plants.*)
 - Raisers' Guild, Castilian, history, 390.
 - scab, 773.
 - Shropshire, fertility in, 368.
 - stock cooperative credit society, rules, 592.
 - stomach worms, studies, 685, 883.
 - Suffolk, history and management, 766.
 - worms, measurement of eggs, 777. (*See also Ewes and Lambs.*)
- Shortening, definition, and measurement, 258.
- Shorts, analyses, Can., 167; Mich., 168.
- Shot-hole borer, susceptibility of woods and treatment, 252.
- Shrews, unrecognized, from California, 456.
- Shrubs—
- broad-leaved evergreen, for the South, 843.
 - bud variations in, 721.
- Silage—
- alfalfa, composition and nutritive value, 269.
 - alfalfa, studies, Mich., 412.
 - and cottonseed meal, feeding value, Tenn., 169.
 - as hay substitute, 372.
 - barley and pea, feeding value, Oreg., 170.
 - barley, yields in Australia, 132.
 - comparison of kinds, 878.
 - composition and nutritive value, 269.
 - corn, analyses, Oreg., 170.
 - corn, composition and nutritive value, 269.
 - corn, studies, Mich., 412; Mo., 372.
 - corn, types, feeding value, Kans., 367.
 - corn *v.* sorghum, feeding value, Ky., 71.
 - corn *v.* sunflower, N.Mex., 372.
 - feeding value, Kans., 478; Oreg., 170.
 - making in Argentina, treatise, 269.
 - mannitol-producing organisms in, 804.
 - oat and tare, digestibility, 871.
 - oat, composition and nutritive value, 269.
 - pea and barley, feeding value, Oreg., 170.
 - produced in barrels, quality, 871.
 - sorghum *v.* corn, feeding value, Ky., 71.
 - sorghum *v.* sunflower, feeding value, N.Mex., 169.

Silage—Continued.

- sunflower, analyses, Can., 269; N.H., 367.
 - sunflower, feeding value, N.H., 367; N.Mex., 173; Oreg., 170; U.S.D.A., 725; Wyo., 676.
 - sunflower, quality in, Mont., 269.
 - sunflower *v.* corn, feeding value, N.Mex., 372.
 - sunflower *v.* sorghum, feeding value, N.Mex., 169.
 - wild sunflower, feeding value, Kans., 478.
- Silica crucibles, use, 805.
- Silicates, effect on wheat, 717.
- Silk—
- from British East Africa, 558.
 - industry and labor in Japan, 246.
 - industry in India, 834.
- Silkworm, physiology, 53.
- Silo construction, wood in, Mich., 598.
- Silos—
- for Alberta, plans, 289.
 - reinforced concrete, construction, 891.
- Silver—
- fish, habits and control, Mich., 558.
 - leaf disease, 451, 551.
- Silvius notatus*, bionomics of, 248.
- Sires—
- dairy herd, Wash., 297.
 - Holstein-Friesian, relative values, Me., 174.
 - Jersey, selecting, 273. (*See also Bulls.*)
- Sirups, dry substances in, 507. (*See also specific kinds.*)
- Sisal—
- determination of flexibility, 230.
 - industry in Antigua, 226.
- Skim milk—
- powder, effect on weanling pigs, 874.
 - powder, vitamin B in, 61.
 - testing, Calif., 578.
- Skins and hair, disinfecting, 480. (*See also Hides.*)
- Skunks, new, 655.
- Slag. (*See Phosphatic slag.*)
- Sludge. (*See Sewage.*)
- Small holdings. (*See Land settlement.*)
- Smicronyx sculpticollis*, notes, 661.
- Smoke injury to trees, 434, 738.
- Smoke injury to vegetation, 738.
- Smut control, fungicidal dusts for, 846. (*See also Cereal smut, Corn smut, Wheat smut, etc.*)
- Snapdragon—
- rust, control, Mass., 653.
 - rust, life history, 844.
 - Septoria, 654.
- Sneezeweed, western, poisonous to live stock, U.S.D.A., 82.
- Snow, analyses, U.S.D.A., 116.
- Social resources of United States, 191.
- Soda pulp from coniferous wood, 617.
- Sodium—
- ammonium nitrate, composition and action, 820.

Sodium—Continued.

- ammonium sulphate and ammonium sulphate, comparison, 819.
- bisulphate, utilization, 718.
- bisulphite, analysis, 114.
- carbonate, analysis, 114.
- chlorid. (See Salt.)
- compounds in 1920, 720.
- cyanid, effect on plants, 544.
- cyanid production, 820.
- determination in blood, 416.
- determination in feces, 417.
- determination in urine, 417.
- lamp, new type, 111.
- nitrate—
 - availability as affected by soil, N.J., 519.
 - effect on nutrition of tomato, 538.
 - fertilizing value, 818.
- salts, solubility in alkali soils, 421.
- sulphate, fertilizing value, 123.
- sulphite, analysis, 114.
- thiocyanate, effect on plants, 544.

Soil—

- acidity—
 - as affected by organic matter, 118, 211.
 - as affected by potash salts, 520.
 - as factor in fertility, 811.
 - determination, iodine method, 503.
 - effect of sulphur, N.J., 549.
 - in northeast India, 811.
 - (See also Lime, Limestone, Liming, and Soils, acid.)
- aeration, deficient, effect, 25.
- analysis—
 - automatic registering method, 814.
 - relation to hygroscopicity, 421.
 - use of layer formation in, 810.
 - value and limitations, 620.
- awakening and seasonal rhythm, 721.
- bacteria—
 - activity as affected by soil treatment, Mo., 315.
 - as affected by arsenic, Mont., 343.
- colloids, adsorption by, 810.
- colloids, origin, 809.
- condition, relation to ammonia formation, 812.
- condition, relation to nitrate accumulation, 813.
- conditions and plant growth, treatise, 809.
- drainage, measurement, 811.
- erosion, studies, Mo., 315.
- experiment fields, guide, Mo., 511.
- ferment, summary, 513.
- fertility—
 - and crop quality, 623.
 - importance of soil reaction in, 811.
 - maintaining, N.H., 318.
 - relation to vitamin content of grain, 624.
 - studies, 336; Guam, 715; Mass., 19.
 - studies, results, 120.

Soil—Continued.

- flora, oxidizing, as affected by plant growth, N.J., 526.
- flora, oxidizing, relation to green plants, N.J., 513.
- inoculation. (See Legumes, inoculation.)
- investigations, new processes, 419.
- investigations, principles, 620.
- management, 623; Mo., 315.
- moisture—
 - as affected by potash salts, 627.
 - classification, 810.
 - conservation, Wash., 217.
 - effect of cultivation, 537.
 - effect on salt balance for plants, N.J., 525.
 - movement, studies, Mo., 315.
 - relation to carbon dioxide formation, 813.
 - streams, importance, 422.
 - studies, 116.
- pollution from sewage, 589.
- pollution, relation to intestinal infections, 538.
- processes as affected by calcium carbonate, 714.
- processes as affected by straw, 423.
- samples, preliminary treatment for analysis, 814.
- science, soil surveys in, 620.
- shrinkage in drained peat bog, Wis., 186.
- silicates as affected by carbonic acid, 821.
- solution—
 - composition and movement, 117.
 - concentration and composition, 420.
 - ferrous sulphate as modifier, 812.
- solutions, electrical conductivity, 517.
- suspensions, formation of layers in, 810.
- temperature—
 - effect on vegetation, 710.
 - effect on absorbing properties, 622.
 - effect on nodule production, 124.
 - in upland and bottomland forests, 211.
- treatment in Rhodesia, 817.
- water. (See Soil moisture.)
- survey in—
 - California, San Joaquin Valley, U.S.D.A., 17.
 - California, southern area, U.S.D.A., 213.
 - Diallah area, 511.
 - Illinois, Ill., 712.
 - Iowa, Adair Co., U.S.D.A., 118.
 - Iowa, Madison Co., U.S.D.A., 422.
 - Iowa, Mahaska Co., U.S.D.A., 814.
 - Iowa, Marshall Co., U.S.D.A., 422.
 - Iowa, Palo Alto Co., U.S.D.A., 17.
 - Iowa, Polk Co., U.S.D.A., 17.
 - Iowa, Winnebago Co., U.S.D.A., 214.

Soil—Continued.

survey in—continued.

- Louisiana, Sabine Parish, U.S.D.A., 815.
- Mississippi, Simpson Co., U.S.D.A., 316.
- Missouri, Chariton Co., U.S.D.A., 119.
- Missouri, Reynolds Co., U.S.D.A., 214.
- Nebraska, Banner Co., U.S.D.A., 18.
- Nebraska, Dakota Co., U.S.D.A., 422.
- Nebraska, Redwillow Co., U.S.D.A., 422.
- North Carolina, Moore Co., U.S.D.A., 815.
- Northern Wisconsin, 511.
- Tennessee, Meigs Co., U.S.D.A., 119.
- Texas, Bowle Co., U.S.D.A., 18.
- Texas, Freestone Co., U.S.D.A., 119.

surveys, procedure, 620.

Soils—

absorbing power, effect of temperature, 622.

absorptive power, 621.

acid—

- inversion of cane sugar by, 621.
 - nature and treatment, 621.
 - treatment, R.I., 220.
- (See also Soil acidity.)

adobe, calcium compounds for, 521.

agricultural, in Germany, distribution, 815.

alkali. (See Alkali.)

alluvial, of Fiji, 316.

ammonification. (See Ammonification.)

aqueous vapor pressure, 18.

arsenic in, 814.

availability of plant nutrients, Ky., 816.

calcium removal from, N.Y.Cornell, 210.

carbon-nitrogen ration in, 715.

courses in Smith-Hughes schools, 791.

distribution and description, handbook, 511.

fallowed and cropped, nitrogen content, 714.

fertilizer requirements, determination, 424.

formation, 619.

heavy, cultivation, effect of chalk, 88.

humus, liming, 621.

hygroscopicity and composition, 421.

hygroscopicity in, 810.

in colored water extract, colorimetric determination, 806.

infertile, cause, Mont., 316.

lime requirement—

- as affected by sulphur, 428.
- effect of organic treatments, 118.
- relation to pH, 812.

Soils—Continued.

magnesia impregnated, 316.

magnesium removal from, N.Y.Cornell, 210.

marsh. (See Marsh soils.)

mold hyphae in, 431.

moor. (See Peat and Moor.)

muck. (See Muck soils.)

nitrogen content. (See Ammonification, Nitrification, and Nitrogen.)

of Argentina, analyses, 423.

of Bulgaria, composition, 423.

of Carmel Valley, pH of, 26.

of central Florida, 213.

of Chautauqua Co., composition, N.Y. State, 423.

of Essex, lime and chalk for, 521.

of Georgia, analyses, 17, 712.

of Hawaii, analyses, 815.

of India, studies, 714.

of Italy, classification, 215.

of Mariut district, Egypt, 816.

of Missouri, manual, Mo., 511.

of Peoria County, Ill., 315.

of South Africa, nitrifying powers, 516.

of Transvaal, analyses, 712.

of West Indies, studies, 815.

of western Washington, management, Wash., 215.

of Willamette Valley, management, Oreg., 214.

organic matter in. (See Organic matter.)

peat. (See Peat.)

phosphates in, solubility, 320.

phosphoric acid requirements, 821.

physical chemical studies, value, 809.

plant nutrients in, determination, 419.

potassium removal from, N.Y.Cornell, 210.

red, origin, 621.

retention of soluble phosphates in, 121.

sedimentation analyses, 517.

sedimentation curves, 623.

sour, qualitative test, 615.

sour, significance, 811.

sterilization, 641; Guam, 715.

studies, Ky., 816.

sulphur removal from, N.Y.Cornell, 211.

swamp. (See Swamp.)

toxicity of salts in relation to osmotic pressure, 209.

ultramicroscopic flora in, 513.

variation of soluble salts in, 623.

water vapor movement through, 811.

Solanum—

macrocarpum as food substitute, 755.

opacum, feeding experiments, 674.

Soldiers. (See Service men.)

Solenopsis molesta, notes, 50.

Solidago, relation to locust borer, activity, Ky., 57.

Solutions, nutrient. (*See* Nutrient.)

Sorghum—

- as forage crop, Mass., 30.
- grain, feeding value, Tex., 365.
- grain, new, White Yolo, 835.
- grain, seeding experiments, U.S.D.A., 636.
- grain, standard grades, 835.
- grain, varieties for silage, Kans., 435.
- grain, variety tests, Guam, 725; Hawaii, 633.
- juice, analyses, Conn.State, 312.
- prussic acid, poisonous to cattle, 484.
- silage. (*See* Silage.)
- sirup making, equipment, 206.
- (*See also* Kafir, Milo, etc.)

Sorrel, African, as food substitute, 755.

Soup extracts, levulinic acid in, 416.

South—

- American States, treatise, 789.
- Carolina Station, notes, 796.
- Carolina Station, report, 793.

Sows—

- brood, winter rations, 874.
- (*See also* Pigs, feeding experiments.)
- immature, breeding, effect on growth, Mo., 362.
- musculature of Graafian follicle, 483.

Soy bean—

- bacterial blight, studies, N.C., 740.
- hay, effect on soil reaction, 211.
- mosaic, 147.
- nodules, forms of nitrogen in, 630.
- oil, production, 636.
- proteins, soluble, preparation, 356.
- yellow dwarf, 242.

Soy beans—

- as affected by calcium, Ky., 816.
- as affected by lime, N.J., 534.
- as affected by sulphur, 428; Wash., 427.
- as hay crop, Mo., 326.
- culture, Ky., 33.
- hogging down, Mo., 364.
- inoculation of soils for, N.H., 328.
- planted with corn, tests, Iowa, 326.
- plowing and disking experiments, Mo., 326.
- seeding experiments, Ky., 33.
- soluble protein extract from, 356.
- varieties, Mich., 633.
- varieties for silage, R.I., 226.
- variety tests, Guam, 726; Hawaii, 633; Ky., 33.

Sparganothis idaeusalis, notes, 749.

Spelt, behavior in crosses, 333.

Spermatogenesis of aphids, 246.

Spermatozoa, survival of motility in, 673.

Sphaeronema—

- adiposum*, notes, 45.
- finibriatum*, notes, 551.

Sphaeropsis malorum, notes, 849.

Sphaerostilbe repens on mango roots, 845.

Sphaerotheca mors-uvae, notes, 243.

Sphaerotrypes, studies, 560.

Sphinx moth, Achemon, control, 658.

Sphryracephala hearseiana, life history, 856.

Spider—

- house, life history, 161.
- mite. (*See* Red spider mite.)

Spiders, red. (*See* Red spiders.)

Spinach—

- breeding, 538.
- canned, adulteration with beet leaves, 311.
- canned, *Bacillus botulinus* infection of, 361.
- canned, bacterial flora, 859.
- effect of preceding crop, R.I., 233.
- effect on following crop, 336.
- leaf mold, control by spraying, 45.
- lime requirements, R.I., 233.
- sun-dried, vitamin content, 359.

Spirochaeta cytophaga, straw treatment with, 217.

Spirochaetosis of fowls, 778.

Spodoptera mauritia on rice, 458.

Spondylocadium atrovirens, notes, 847.

Spongospora subterranea, notes, 847.

Spotted fever tick, control, 59, 555.

Spray—

- materials, studies, Mass., 50.
- mixtures, chemistry of, 501.
- mixtures for fruit trees, 851.
- mixtures for potatoes, N.J., 548.

Spraying—

- dust. (*See* Dusting.)
- in India, 544.
- safe and efficient, 51.
- (*See also* Apples, Potatoes, etc.)

Sprays—

- copper. (*See* Copper.)
- value, 447.
- (*See also* Insecticides and Fungicides.)

Spruce—

- budworm in New Brunswick, 56.
- budworm survey, 51.
- redwood and whitewood, relative strength, 888.
- tortrix, notes, Mich., 457.
- white, soda and sulphate pulps from, 617.
- windfall injuries, 645.

Squash—

- canned, bacterial flora, 859.
- Hubbard, improvement, Vt., 138.

Squirrels—

- activities as affected by climatic conditions, 555.
- ground, susceptibility to strychnin, 655.

Stable—

- fever. (*See* Pleuropneumonia.)
- fly, life history and habits, 661.

Staggers of cattle in Natal, 776.

Stallions, enrollment, Ind., 768.

Staphylococcus—

- aureus* growth, effect of vitamin B, 80.
- pyogenes albus*, notes, 777.

Star grass, culture in Africa, 232.

Starch—

- foreign, in flour, detection, 807.
- hydrolysis, effect of amino acids, 707, 708.
- industry, present status, 308.
- manufacture from rice, 508.

Statice rust, notes, 844.

Statistical reporting service, program, 596.

Stauronotus maroccanus, outbreaks, 657.

Steam, effect on plants, 544.

Steers—

- changes in form and weight on different diets, Mo., 66.
- feeding experiments, Ind., 476; Kans., 366; Ky., 71, 367; Mo., 364; N.C., 269; Oreg., 169; Tenn., 169; Wyo., 676.
- shelter and warm water for, Oreg., 170. (See also Cattle.)

Stegomyia—

- aegypti*, notes, P.R., 157.
- calopus*, feeding habits, 248.

Stegomyia, earliest name, 661.*Stemphylium* in sugar solution, studies, 206.*Stephanoderes hampei*, notes, 159.*Stephanurus dentatus*, description, 83.*Stereum purpureum*, fruiting bodies and control, 451.*Stigmatocystis* in sugar solutions, studies, 206.

Sterility—

- defective diet as cause, 261.
- pathology of organs in, Mich., 482.

Sterilization and disinfection, treatise, 310.

Sterilizing agents, effect on plants, 544.

Stilbella flavida on coffee, P.R., 454.*Stilbum flavidum*, notes, 647.

Stinkwort, eradication, 138.

Stock. (See Live stock.)

Stock foods. (See Feeding stuffs.)

Stomach—

- bacterial content as effected by saliva, 862.
- worm in sheep and goats, 883.
- worms in sheep, studies, 685.

Stomata—

- and hydathodes in *Campanula*, 523.
- guard cells, variations in osmotic concentration, 631.
- morphogenesis, 322.

Stomatitis, contagious pustulous, in sheep, 484.

Stomoxys calcitrans. (See Stable fly.)

Stone for road building. (See Road materials.)

Storax production, American, 341.

Strategus spp., life cycle, 251.

Straw—

- artificial manure from, 217.
- effect on nitrate accumulation in soil, 622.
- effect on soil processes, 423.
- fertilization, injurious action, 818.
- grades, 30.
- hydrolyzed, feeding value, 67, 572.
- hydrolysis, theory and practice, 203.

Strawberries—

- breeding experiments, 39, 125.
- culture, 540.
- everbearing, culture, Guam, 733.
- everbearing, culture in Canada, 234.
- in Connecticut, 39.
- new, origin, 640.
- picking while wet, 447.
- storage studies, 338.
- varieties in Canada, 138.
- variety tests, 839.
- vitamin C content, 667.

Strawberry—

- Botrytis*, notes, 741.
- crown borer, control, Ky., 462.
- root weevil, popular account, 159.
- rootworm on roses, N.J., 557.
- soft rot, 544.
- tree, parasitic disease of, 244.
- wilt, 44.

Stream—

- flow as affected by forest cover, 738.
- flow as affected by forests, 141.
- flow experiment, U.S.D.A., 779.
- flow measurements in Canada, 380.
- gauging, instructions, U.S.D.A., 688.

Streptococci—

- ammonia production by, 274.
- carbon dioxide production by, 274.

Streptococcus—

- lanceolatus*, notes, 777.
- pyogenes*, notes, 777.
- spp. in lactic starters, 76.
- spp. in starters, volatile acid production, Iowa, 76.

Striga lutea, parasitism by, 343.*Strigoderma arboricola*, studies, 252.

Strongylid parasites of horses, 485.

Strongylosis in horses, 686.

Strongylosis, gastrointestinal, of sheep and goats, 883.

Strongylus spp. as affected by thymol, 885.

Strontium—

- in plants, Colo., 28.
- process in sugar manufacture, 616.

Structural design, treatise, 486.

Strychnin—

- repeated injections, tolerance of rats to, 655.
- toxicity to animals, U.S.D.A., 654.

Stumps—

- as affected by salt, 733.
- removal with explosives, U.S.D.A., 85.

Sturmia sociabilis n.sp., description, 57.

Suberin and cutin in plants, 631.

Sucrose—

- and raffinose mixtures, analysis, 205.
- determination, 506.
- determination, use of invertase for, 506.
- in presence of glucose, test, 807.

Sudan grass—

- and related plants, U.S.D.A., 441.
- as pasture crop, Iowa, 363; Kans., 478.
- feeding, effect on horses, 678.

Sudan grass—Continued.

- hydrocyanic acid in, 179.
- leaf blotch, 647.
- prussic acid, poisonous to cattle, 484.
- seed screenings, analyses, Tex., 675.
- seed, weeds in, 838.
- yields, Mo., 326.

Suet, detection in lard, 14, 311.

Sugar—

- crystals, examination, 113.
- determination in urine, 417.
- dietetic value, 258.
- industry and by-products, 535.
- industry in Antigua, 226.
- inversion by mineral acid soil, 621.
- (See also Invertase activity.)
- kinds in same material, determining, 506.
- manufacture, use of lime, barium, or strontium in, 616.
- mixtures, analysis, formulas, 807.
- mold hyphae in, 431.
- solutions, deterioration, cause, 206, 417.

(See also Sugars.)

Sugar beet—

- diseases, 450, 744.
- dry-rot canker, 147.
- industry in United States, U.S.D.A., 134.
- industry, technology, 417.
- nematodes, 744.
- seed, selection by refractometer, 807.
- sirup, examination, 507.
- sirup, making, 207; U.S.D.A., 207.
- (See also Beet.)

Sugar beets—

- as affected by climate, 115.
- as affected by salt, 719.
- composition and yield, factors affecting, 637.
- culture experiments, 131.
- effect of preceding crop, R.I., 233.
- fertilizer experiments, Mich., 518.
- rotation experiments, U.S.D.A., 725.
- variety tests, 131.

Sugar cane—

- culture, V.I., 33.
- culture experiments, 131, 227, 437, 634, 836.
- culture in New South Wales, 135.
- disease, new, in Philippines, 347.
- disease survey in India, 544.
- diseases, 550.
- diseases in Philippines, 45.
- fertilizer experiments, 131, 227, 437, 534, 634, 727, 836.
- Fiji disease, 45, 46, 346, 347, 651.
- froghopper blight in Trinidad, 154.
- frozen, utilization, 34.
- fungi, check list, 346.
- grubs, 153.
- gumming disease, 148.
- gummosis in Porto Rico, 450.
- gummosis, studies, 242.
- insects affecting, 153, 748.

Sugar cane—Continued.

- insects of Porto Rico, 558.
- irrigation experiments, 634.
- juice, clarification, 508.
- juice, color and colloids as affected by carbons, 508.
- juice, decolorization as affected by pH., 508.
- juice, nondefecable, causes, 616.
- Lahaina disease, 347; Hawaii, 647.
- leafhoppers, notes, 558.
- mosaic. (See Sugar cane mottling disease.)
- mottling disease, 46, 347.
- mottling disease, description, 346.
- new moth pest in Queensland, 658.
- pineapple disease, 46.
- pollination apparatus, 135.
- root borer, notes, 534.
- root disease, 550, 647.
- root parasites, 343.
- root rot, 347.
- rotation experiments, 437.
- seedlings from Tucuman, 135.
- serch, description, 346.
- sirup manufacture, invertase in, 312.
- smut, 46.
- spacing experiments, 535.
- top-rot disease, 46.
- varieties in Java, 441.
- varieties, key, 730.
- varieties, list, 835.
- varieties, yields, 727.
- variety tests, 131, 226, 227, 437, 534, 535, 634.
- white grubs affecting, 250.
- windrowing, 730.
- yellow stripe. (See Sugar cane mottling disease.)
- yields, 534.

Sugars—

- rare, standardization, 113.
- reducing, in lead-preserved cane juices, 506.
- reducing, quantitative determination, 113.
- South African, deterioration, 206, 417, 418.
- (See also Dextrose and Sucrose, etc.)

Sulco, V. B., tests, Mass., 50.

Sulfofication, solvent action of, Ohio, 428.

Sulgene, effect on plants, 544.

Sulphate—

- of ammonia. (See Ammonium sulphate.)
- of potash. (See Potassium sulphate.)
- pulp from coniferous wood, 617.

Sulphates, relation to plant growth, 123.

Sulphids, dry, and lime-sulphur, comparison, Mass., 50.

Sulphite pulping process, modification, 808.

Sulphur—

- as plant food, 428; Wash., 427.
- availability, effect of liming, 24.
- compounds for control of rust mites, 355.

Sulphur—Continued.

- effect on crops, 717.
- effect on hydrogen-ion concentration of soil, 428.
- effect on lime requirement of soils, 428.
- effect on nitrogen content of legumes, 120.
- Fellowship of National Research Council, 899.
- fertilizing value, 120, 822.
- for control of potato scab, N.J., 549.
- fumes, effect on trees, 454.
- in rain water, 16.
- in soil, effect on crops, 428.
- mixtures. (See Lime-sulphur.)
- oxidation by microorganisms, 822.
- removal from soil, N.Y.Cornell, 211.
- value for potato scab, 649.

Sulphuric acid, production and sale, 430.

Sulphurous acid, determination, 415, 805.

Sumac, smooth, organic acids of, 308.

Sunflower—

- green shoots, vitamin A content, 357.
- seed feeding value, Mo., 363.
- silage. (See Silage.)

Sunflowers—

- as silage crop, N.H., 367.
- culture on peat soil, 216.
- fertilizer experiments, Mich., 518.
- Russian, culture and feeding, N.Mex., 135.
- seed production, Mont., 327.
- seeding experiments, Mont., 327.
- variety tests, 227.
- wild, as silage crop, Kans., 478.

Sunshine as cure for rickets, 165.

Sunshine efficiency in hog houses, 99, 891.

Sunspots, relation to rainfall, 209.

Superphosphate—

- effect of weather exposure, 219.
- fertilizing value. (See Phosphates, comparison.)
- manufacture, 627.
- manufacture, use of sodium bisulphate in, 718.
- production and sale, 430.

Surra—

- in camels, treatment, 777.
- transmission by ticks, 881.

Swamp and overflowed lands, reclamation, 381.

Swedes—

- fertilizer experiments, 131.
- variety tests, 227 ; N.H., 328.

Sweet clover—

- annual white, culture, Mont., 327.
- annual white, notes, Iowa, 326.
- as affected by calcium, Ky., 816.
- as forage crop, Mass., 30.
- barium in, Colo., 28.
- culture, Tex., 328.
- fertilizer experiments, Mich., 518.
- mosaic disease, 848.
- seed, identity, 732.
- varieties, Mich., 633.

Sweet corn—

- effect of liming, N.H., 318.
- manuring experiments, N.H., 318.
- (See also Corn.)

Sweet potato—

- black rot, control, 551.
- diseases, 543.
- diseases, control, 551.
- leaves, vitamin content, 667.
- pox, studies, Del., 646.
- storage diseases, Tex., 343.
- weevil, eradication in Florida, U.S. D.A., 462.

Sweet potatoes—

- breeding experiments, S.C., 725.
- canned, discoloration in, 15.
- canning studies, U.S.D.A., 664.
- culture, Ala.Tuskegee, 730.
- culture experiments, Guam, 726.
- hardening process in, Mo., 827.
- improvement by selection, 830.
- keeping quality, 135.
- recipes, Ala.Tuskegee, 730.
- storage experiments, 226.
- storage rots, control, 551.
- variety tests, 226 ; Hawaii, 633.
- yields in New Jersey, 225.

Swine—

- diseases, Ky., 883.
- dysentery, Ind., 582.
- fertility as affected by age, 73.
- fever, occurrence in Great Britain, 178.
- husbandry, course in, 898.
- inheritance of belting spotting, 268.
- international trade, 675.
- ovaries, corpora lutea in, 266.
- pneumonia, studies, 83.
- (See also Pigs.)

Syngrius fulvitaris, notes, 58.

Symbiosis and parasitism, 655.

Symptomatic anthrax. (See Blackleg.)

Synapsis, 173.

Synecephalastrum sp. in corn meal, 356.

Synechtrium endobioticum—

- history and distribution, 550.
- notes, 650.
- symptoms and history, 242.

Syphilis, serum diagnosis, 276.

Tabanidae, Australian, life history and habits, 248.

Tabanus spp., bionomics of, 248.

Tachinidae—

- of North Carolina, list, 460.
- Texas, host records, 750.

Taenia perfoliata as affected by thymol, 885.

Tankage, analyses, Mich., 168 ; Tex., 675.

Tannias, variety tests, 226.

Taphrina deformans, notes, 453.

Tarnished plant bug, distributor of fire-blight, 348.

Taro—

- culture experiments, Guam, 726.
- rot, control, Hawaii, 647.

- Tarsonemus woodi*, in bees, 464, 858.
 Tartar emetic, treatment for surra, 777.
 Tartaric acid, manufacture from grape marc, 509.
 Taste, physiology and psychology of, 563.
 Taxes and agriculture in France, 894.
 Taxes on sales of land and capital goods, 894.
 Tea—
 brown blight, control, 448.
 diseases, 845.
 diseases, prevention, 561.
 Temperature types, composite, of United States, 314.
 (See also Climate and Soil temperature.)
 Tenai, Piricularia on, 448.
 Tennessee—
 Station, notes, 797.
 University, notes, 299.
 Tent caterpillar—
 in South Dakota, 750.
 notes, 51.
 Tepary beans as food substitute, 755.
Termes lucifugus, habits and control, 656.
 Termites—
 bionomics of, 656.
 destruction by chloropicrin, 656.
 in buildings, control, N.H., 350.
 of Porto Rico, 558.
 of South Africa, key, 345.
 Testes, development as affected by inanition, 265.
 Tetanus—
 antitoxin, curative value in horses, 279.
 bacilli as affected by pH, 683.
 serum prophylaxis and therapy, 481.
 toxin, paths of spread, 181.
Tetradymia glabrata, poisonous to sheep, 396.
 Tetranychidae, new Nearctic, 161.
Tetranychus spp., control, 160.
 Tetrphosphate as fertilizer, 718.
 Texas—
 fever. (See Piroplasmosis, bovine.)
 fever ticks. (See Cattle ticks.)
 Station, report, 394.
 Textile—
 fibers, determination of flexibility, 230.
 industry, animal fibers in, 770.
 Thalassiophyta and subaerial transmigration, 524.
Theridion tepidariorum, life history, 161.
 Thermos flask, laboratory uses, 614.
Thielavia basicola, notes, Ky., 848.
Thielaviopsis paradoxa, notes, 45, 46, 647.
Thiobacillus thiooxidans, notes, 822.
 Thirst, effect on weight and growth, 264.
 Thistles—
 control, 727.
 Russian, notes, 536.
 Thomas ammonium calcium phosphate, storage experiments, 820.
 Thomas slag. (See Phosphatic slag.)
 Thrips in Costa Rica, 647.
 Thyme, Spanish, as food substitute, 755.
 Thymol—
 action on intestinal parasites of horse, 885.
 efficiency against hookworms in silver black fox, 184.
 taenicial value, 687.
Thyridopteryx ephemeraeformis. (See Bagworms.)
 Thyroid feeding, effect on creatinuria, 65.
 Thyroidectomy effect on lambs' wool, 72.
 Thysanoses, North American, key, Miss., 461.
Tibicina septendecim. (See Cicada, periodical.)
 Tick—
 control in Montana, 59.
 control in Trinidad, 82.
 fever. (See Piroplasmosis, bovine.)
 paralysis, 775.
 Ticks—
 human, transmitting agent of relapsing fever, 682.
 infesting live stock in Rhodesia, 465.
 spotted fever, control, 59, 555.
 transmission of surra by, 881.
 (See also Cattle tick and Ear tick.)
 Tikitiki extract, preparation, 569.
 Tile drainage. (See Drainage.)
Tilletia—
 levis, germination, relation to hydrogen-ion concentration, Mo., 344.
 tritici, notes, 239.
 Tilletiaceae, distribution in Baltic regions, 239.
 Timber—
 decay, cause and prevention, 382.
 farm, measuring and marketing, U.S. D.A., 237.
 farm preservative treatment, 86.
 Indian, trade names, 843.
 injury from lepidopterous larvae, 750.
 Philippine, tests, 283.
 plantations, establishment in Africa, 42.
 trees, diseases, 454.
 trees of Sao Paulo, Brazil, 236.
 volume tables, alinement chart method, 739.
 (See also Lumber and Wood.)
 Timberlands, American, valuation, treatise, 444.
 Timothy—
 as cover crop for tobacco, Conn.State, 332.
 seed germination, effect of blue blotting paper, 732.
 Tin compounds, effect on wheat, 716.
 Titanium in plants, Colo., 28.
 Titration—
 methods, Mich., 413.
 of acids and bases, two indicators, for, 413.
Tmetocera ocellana. (See Bud moths.)
 TNT. (See Trinitrotoluol.)
 Tobacco—
 angular leaf spot, Ky., 848.
 barium in, Colo., 28.

Tobacco—Continued.

- culture, Wis., 333.
- culture and curing, Can., 136.
- culture and curing in Spain, 136.
- culture experiments, 131; Can., 836.
- culture in Colombia, 391.
- curing barns and packing house, 588.
- disease survey in India, 544.
- diseases and pests, Can., 836.
- diseases in Deli, 551.
- dust and lime, insecticidal value, N.H., 350.
- experiments in Africa, 227.
- fertilizer experiments, 131, 638; Can., 836.
- harvesting methods, Can., 836.
- Hibshman strain, tests, 837.
- industry in Porto Rico, 837.
- injury by caterpillars, 53.
- insects affecting in Dutch East Indies, 153.
- lime requirements, R.I., 233.
- lithium in, Colo., 28.
- marketing association, 595.
- perique, culture and uses, 837.
- Peronospora disease, 651.
- production in Kamerun, 232.
- production in Nyasaland, handbook, 227.
- production in Philippines, 232.
- root rot, Ky., 848.
- soils, studies, Can., 817.
- soils, tillage experiments, 715.
- statistics, 135.
- strontium in, Colo., 28.
- timothy as cover crop, Conn.State, 332.
- varieties, Can., 836.
- varieties, new cigar, Ohio, 333.
- variety tests, 131, 836.
- wildfire, Ky., 848; Mass., 43.
- wildfire, control, Mass., 651.

Toluene, effect on activity of amylases, 707.

Tomato—

- blight, control, 745.
- blight, early, notes, Tex., 343.
- blight, western, 144.
- blossom end rot, control, Del., 640.
- damping-off, 447.
- disease survey in India, 544.
- diseases, 447, 451.
- diseases and pests, 451.
- hardening process in, Mo., 827.
- juice, antiscorbutic value, 475.
- juice, desiccated, antiscorbutic value, 359.
- leaf firing, notes, Tex., 343.
- leaf roll, resistant variety, 734.
- leaf spot, Mass., 43.
- leaf spot, control, 745.
- Macrosporium foot rot, 148.
- moth, control, 53.
- Phytophthora disease, 848.
- Sclerotinia wilt, 849.
- stem disease, 543.
- seed press cake, proteins, nutritive value, 564.

Tomato—Continued.

- sleepy disease, 543.
- spotted wilt, cause, 451.
- spotted wilt, overwintering, 745.
- stem rot, notes, 43, 844; Del., 646.
- stem-end rot, 849.
- stripe disease, 447, 543.
- wilt resistant varieties, La., 849.
- wilt, spotted, 44.
- wilt, spraying experiments, 551.
- winter blight, causes, 844.

Tomatoes—

- as affected by sodium nitrate, 538.
- breeding, 839.
- can-house, cost of production, N.J., 590.
- canned, bacterial flora, 859.
- canned, standards for, 15.
- canning studies, U.S.D.A., 664.
- cost of production, Miss., 590.
- fertilizer experiments, N.H., 335; N.J., 537.
- for canning and manufacturing, U.S. D.A., 139.
- forcing with neon light, 640.
- greenhouse, fertilizer experiments, R.I., 233.
- hardiness, varietal differences, 838.
- hybrid, for Guam, Guam, 734.
- hydrocyanic acid injury, 641.
- pollination studies, 734.
- Septoria lycopersici* on, 46.
- soil sterilization for, 641.
- spraying, effect of pressure, Va. Truck, 336.
- sterilization, 754.
- sun-dried, vitamin content, 359.
- variety tests, N.H., 335.

Toxoptera graminum, method of study, 245.

Traction dynamometers, 585.

Tractor—

- and other farm equipment costs, Mo., 387.
- construction, materials for, 287.
- engines, handbook, 890.
- index, 385.
- plowing tests, 87, 88.
- plows. (See Plows.)

Tractors—

- cost and utilization, U.S.D.A., 383.
- demonstration at Fargo, 288.
- drive wheel slippage, prevention, 890.
- drive wheels, metal shoes for, 586.
- dynamometers for, 491.
- in New York, N.Y.Cornell, 287.
- leveling device for hillside work, 890.

Tradescantia green shoots; vitamin A content, 357.

Trametes pini on blazed trees, 151.

Transpiration—

- in plants, 224.
- of desert plants, seasonal changes, 26.
- studies with apples, 128.

Trapping, handbook, 455.

Tree—

- biology, treatise, 221.

Tree—Continued.

- growth and climatic cycles, 27.
- growth measured by dendrograph, 24.
- protection, examining board, report, Conn.State, 340.
- rots, notes, 741.

Trees—

- American, in Scotland, 737.
- blazing, pathological effect, 150.
- bud variations in, 721.
- coniferous. (*See* Conifers.)
- falling foliage, N.J., 529.
- forest, germination and culture of seeds, 444.
- forest, growth tests, Kans., 444.
- forest, viability of seeds, 542.
- injury from mistletoes, 245.
- need along public highways, U.S.D.A., 86.
- of Java, epiphytes on, 720.
- of North America, treatise, 737.
- of West Indies, 737.
- planting on prairies of Canada, 843.
- propagation from seed, 843.
- smoke injury to, 434.
- street, planting and care, U.S.D.A., 41.

Tricalcium arsenate, preparation and instability, 613.

Trichomonas suis, notes, Ky., 884.

Trichuris—

depressiuscula extracts, experiments, 379.

ovis in sheep, 685.

Trifolieae, anatomical studies, 222.

Trinitrotoluol, use in blasting stumps, U.S.D.A., 85.

Trioza viridula, notes, 153.

Triphragmium trevesiae n.sp., description, 829.

Tri-State Development Congress, report, 292.

Trochilidae, synopsis and catalogue, 555.

Trombicula spp., descriptions, 560.

Trout, diallel crossings with, 268.

Truck farms, surveys, N.J., 590.

Trucks. (*See* Motor Trucks.)

Trypanosoma lewisi in Boston rats, 279.

Trypanosomes of cattle, 484.

Tryptophan—

- content of foods, 758.
- effect on starch hydrolysis, 708.
- estimation and isolation, 112.
- requirement of adults, 758.
- stability, 112.

Trona potash, effect on crops, S.C., 717.

Tsutsugamushi disease carriers, 560.

Tubercle bacilli—

- action of oils on, 579.
- antigenic value of methyl alcohol extract, 376.
- bile-treated, studies, 581.
- bovine, rôle in human tuberculosis, 174.
- transmission by eating utensils, 361.
- types, significance, 683.

Tuberculin—

- hypersensitiveness induced by bacillus-free filtrates, 182.

Tuberculin—Continued.

- reaction, studies, 376.
- test, combination, 182.
- test, intradermal, directions, 482.
- test of fowls, 280.
- test, ophthalmic, use, 182.
- test, subcutaneous, directions, 182.
- tests in cattle, 183.
- tests, recording, 482.

Tuberculosis—

- avian, control, 775.
- bovine, 881.
- bovine, control, 377.
- complement fixation tests, 482.
- control in Massachusetts, 681.
- eradication, accredited-herd plan, 482.
- focal reaction in, 280.
- human, rôle of bovine type in, 482.
- immunization with bile-treated bacilli, 182.
- immunizing vaccine, 280.
- in horses, summary, 482.
- occurrence in Great Britain, 178.
- of poultry, Idaho, 686.
- reference book, 182.
- relation to malnutrition, 869.
- serum diagnosis, 276.
- transmission in hog cholera inoculations, Mo., 379.
- value of flavin compounds in, 775.

Tularaemia, occurrence and transmission, 151, 662.

Tulip—

- Botrytis blight, N.Y.Cornell, 654.
- bulb dry rot, 544.
- bulbs, treatment and storage, Can., 236.
- wood, Brazilian, identity, 843.

Turnip—

- mosaic disease, 148.
- tops, sun-dried, vitamin content, 359.

Turnips—

- fertilizer experiments, 227.
- green shoots, vitamin A content, 357.
- seeding dates, 531.
- seeding experiments, 227.
- sun-dried, vitamin content, 359.
- variety tests, 227; N.H., 328.
- yields, 533.

Turpentine refining, 313.

Twitch grass—

- production and germination, 639.
- seed, production and germination, 844.

Tyloclasma fragariae. (*See* Strawberry crown-borer.)

Typha insects, ecological relations, N.Y.Cornell, 465.

Typhlocyba comes. (*See* Grape leafhopper.)

Typhoid—

- bacilli, viability in excrement, 588.
- equine. (*See* Influenza, equine.)
- fly. (*See* House fly.)

Typhoid-paratyphoid bacilli in milk, effect of pasteurization, 275.

Typophorus canellus on roses, N.J., 557.

Tyrosin, effect on starch hydrolysis, 707.

Ultraviolet—

- light, effect on metabolism, 870.
- rays, injurious effect on plants, 224.

Uncinaria spp., in foxes, 886.

Undernutrition—

- effect on mammal ovary, 567.
- physiological effect, 471.

(See also Malnutrition and Nutrition.)

United—

- Grain Growers, report, 894.
- States Department of Agriculture, reports, 598.
- States Veterans' Bureau vocational schools, agriculture in, 399.

Urea—

- composition and action, 820.
- replacement of feed protein by, 67, 68.
- superphosphate, composition and action, 820.

Uredo kuehnii, notes, 45.

Urine—

- calcium determination in, 417.
- cow, nitrification, 714.
- magnesium determination in, 417.
- nitrogen determination in, 615.
- potassium determination in, 417.
- sodium determination in, 417.
- sugar determination in, 417.

(See also Manure, liquid.)

Urocystis—

- cepulae* in England, 548.
- cepulae*, relation to climate and culture, 345.
- sp., notes, 544.

Uromyces—

- appendiculatus*, notes, 845.
- betae* on sugar beets, 450.
- caryophyllinus*, temperature of spore germination, N.H., 343.
- limonium*, notes, 844.
- trifolii*, notes, 449.

Uromyces on clover, biology, 743.

Urophlyctis leproides on sugar beets, 450.

Ustilaginaceae, distribution in Baltic regions, 239.

Ustilago—

- sacchari*, notes, 45, 46.
- spp. germination, relation to H-ion concentration, Mo., 344.
- spp., notes, 239.

Ustilina zonata, host plants, 455.

Utah College and Station, notes, 299.

Vacuoles—

- metachromatin and tannic compounds in, 723.
- origin in root cells, 823.

Van Fleet, W., plant-breeding activities, 541.

Vanilla diseases, 454.

Variation in red clover, 438.

(See also Heredity and Mutation.)

Varnishes, films, stress-strain measurements, 586.

Vascular anatomy of bean seedlings, 825, 826.

Vegetable—

- biology, elements, textbook, 221.
- gardening. (See Gardening.)
- growths in sewage trickling filters, 492.
- histology, elements, 322.
- investigations at experiment stations, 443.
- marrow as substitute for apple, 258.
- oils. (See Oils.)
- proteins. (See Proteins.)

Vegetables—

- canned, bacterial flora, 859.
- canning, U.S.D.A., 208.
- culture, treatise, 138.
- for diabetic diets, 570.
- green, cooking, 258.
- hardening process in, Mo., 827.
- hardiness, varietal differences, 838.
- home storage, 386.
- insects affecting. (See Garden insects.)
- nomenclature of varieties, 129.
- pentosan content, relation to hardiness, 443.
- storage in winter, Wash., 233.
- sun-dried, vitamin content, 359.
- yields, effect of cultivation, 537.

Vegetation—

- changes in, effect of grazing, 28.
- effect on soil temperature, 720.
- injury from poisonous gases and smoke, 738.
- strand, ecology, 27.

(See also Flora.)

Velvet beans—

- as cover crop, Guam, 726.
- Georgia, analyses, 108.
- improvement by selection, 830.
- proteins, digestibility, 163.

Ventilation—

- of dairy barns, 99, 587.
- stable, design of outtake flues, 491.

Venturia—

- inequalis*, notes, 243.
- pomi*, notes, 543.

Verticillium—

- albo-atrum*, notes, 544.
- spp., notes, 447.

Vespa maculata, mouth parts, studies, 560.

Vetch—

- culture experiments, 436.
- seed, hairy, testing, 732.
- varieties, Mich., 633.

Veterinary—

- hygiene, treatise, 178, 773.
- obstetrics, treatise, 178.
- physiology, essentials, treatise, 681.
- secrets, rural, treatise, 880.
- service in the war, treatise, 479.
- surgeons, register, 773.

(See also Animal diseases.)

Vineyards. (See Grapes.)

Virginia Station, notes, 397, 797.

Viruses, filterable and ultraviolet, 81.

Viscum on Casuarina, 343.

Vitamin—

- A and antirachitic vitamin, 165.

Vitamin—Continued.

- A and C deficient diet, effect on guinea pig, 567.
- A and fat-free diet, 256.
- A and phosphorus deficient diet, effect, 472, 473.
- A and xerophthalmia, relation, 760.
- A deficient diet, effect, 472, 473.
- A deficient diet, ophthalmic reaction from, 469.
- A in butter, 357, 680.
- A in carrot seed, 357.
- A in citrus fruit peel, 567.
- A in fats, relation to nutritive value, 256.
- A in fats, relation to yellow pigments, 61.
- A in fish-liver oils, 567.
- A in food, estimation, 806.
- A in milk, 357, 680.
- A in palm kernel oil, 256.
- A in pea seed, 357.
- A in peas, relation to yellow pigments, 257.
- A in plant tissues, formation, 356.
- A, relation to rickets and growth in pigs, 64.
- antiberiberi, discussion, 864.
- antineuritic. (See Vitamin B.)
- B and C, differential dialysis, 11.
- B and coenzymes, 866.
- B and secretin, differentiation, 761.
- B deficiency, effect on lymphocytes, 867.
- B deprivation and fasting, effect on rats, 62.
- B, effect on appetite, 868.
- B, effect on growth of *Staphylococcus aureus*, 80.
- B, effect on secretory glands, 760.
- B in rice polishings, 204.
- B in skim milk powder, 61.
- B in yeast, 204.
- B in yeast, differentiation from co-enzyme, 309.
- B isolation, 864.
- B plant sources, 667.
- B relation to nutrition, 358.
- B studies, 760.
- B synthesis by yeasts, 61.
- B synthesis, tests, 760.
- B therapeutic possibilities, 868.
- B yeast test as measure, 164.
- C destruction, 865.
- C destruction as affected by temperature and pH, 667.
- C, effect of heat and oxidation, 469.
- C, effect of heating with invertase, 761.
- C extracts, color reaction, 668.
- C in lemon juice, desiccated, 359.
- C in lemon juice, effect of sterilization, 761.
- C in lemon juice, stability, 475.
- C, plant sources, 667.
- C studies, 865.
- content of eggs, relation to feed, Kans., 478.

Vitamin—Continued.

- content of flour, 470.
 - content of foods, effect of processes, 257.
 - content of foods, factors effecting, 864.
 - content of grain as affected by soil fertility, 624.
 - content of milk and milk products, 60, 61, 357, 680.
 - content of oil, effect of hydrogenation, 565.
 - content of oleomargarin, 256.
 - content of plant tissue, effect on bacterial growth, 866.
 - content of sun-dried vegetables, 359.
 - content of wheat bran, 256.
 - D, growth stimulant for yeast, 759.
 - deficiency and exposure to X-rays, similar effects, 62.
 - doctrine, and oleomargin industry, 256.
 - food tablets, use, 356.
 - requirements of bacteria, 759.
 - rich diet, effect on backward children, 868.
- Vitamins—
- and cod liver oil, 256.
 - and diet, Ark., 667.
 - and nutrition, 256, 257.
 - and rickets, review of literature, 257.
 - chemical nature of, 864.
 - effect of heat, 360.
 - effect on growth of pigs, Iowa, 362.
 - extracting and concentrating, 11.
 - manual, 256.
 - physiological significance, 469.
 - production, rôle of microorganisms in, 866.
 - relation to health, 62.
 - rôle in bacterial growth, 80.
 - studies, 271.
 - studies at experiment stations, 603.
 - studies, standardization of methods, 864.
 - treatise, 863.
- Vocational education—
- home-making, 296.
 - in Massachusetts, 696.
 - laws in Wisconsin, 897.
 - social objections, 193.
 - (See also Agricultural education.)
- Vocational rehabilitation in rural communities, 793.
- Walking stick, injury to coconut, Guam, 748.
- Walnut—
- bacterial blight, 144.
 - bacteriosis, 544.
 - husk maggot, life history, U.S.D.A., 249.
 - shoot growth rate, nature of, 127.
- Walnuts—
- American, description, 342.
 - culture, Calif., 235.
 - dying out in France, 653.
 - Persian, culture in British Columbia, Can., 141.
- Wampee hog pasture, U.S.D.A., 874.

Warble fly, summary, 661.

(See also Bot flies and Ox-warble.)

Washington—

College and Station, notes, 198, 300, 797.

Substation, Western, bulletin, 297, 498.

Wasps—

heredity in, 463.

new species, descriptions, 160.

parasitic, rearing, 456.

Philippine, new, descriptions, 58.

Water—

absorption in soil, Mo., 315.

and soil mixtures, sedimentation curve, 517.

balance of the body, 861.

buffalo as dairy animals, 573, 577.

carbonated, viability of colon-typhoid group in, 754.

flow in open channels, effect of curvature, 283.

hot, effect on concrete, 283.

hot, effect on plants, 544.

hot, treatment for Japanese beetle larvæ, 252.

hyacinth, description and control, 233.

hyacinth, eradication, 138.

irrigation. (See Irrigation water.)
of bogs, oxygen content, effect of cloudiness, 632.

of Santa Clara Valley, softening, Calif., 537.

pollution from sewage, 589.

power development in South, 381.

rain. (See Rain.)

resources, treatise, 687.

stage registers, installation, U.S.D.A., 688.

supply of Mariut district, Egypt, 816.

supply, underground, of Tasmania, 779.

tunnels, tables for designing, 380.

vapor, saturated, movement through quartz flour, 811.

Watermelon—

anthracnose, control, Tex., 343.

stem and blossom end rot, control, Tex., 343.

wilt, control, Tex., 343.

Waterproofing agents for canvas, 188.

Water-soluble B. (See Vitamin B.)

Water-soluble C. (See Vitamin C.)

Weather—

conditions in 1921, U.S.D.A., 510.

control, 418.

effect on flour milling, 860.

exposure, effect on superphosphate, 219.

forecasting, rôle of cirrus in, 711.

forecasts, long-period, 16.

on New England farm, 116.

weekly notes, U.S.D.A., 596, 789.

(See also Meteorological observations and Meteorology.)

Weathering and soil formation, 619.

Webworm, fall—

in South Dakota, 750.

notes, 51.

Weed—

seeds, identification, Can., 168.

seeds, tolerance limits in, 732.

Weeds—

and weed seeds of Canada, 443.

control, 536; N.J., 137.

depreciating meadows, 129.

eradication, cooperative experiments, 226.

eradication studies, 844.

eradication with salt, 733.

in Sudan grass seed, 838.

newly recorded in New South Wales, 137.

Wells, pollution, 589.

West—

Indian Agricultural College, 399.

Virginia University and Station, notes, 199.

Whale manure, nitrification, 516.

Wheat—

as affected by ferrous oxid, 717.

as affected by iron, 629.

as affected by silicates, 717.

as affected by sulphur, Wash., 427.

as affected by tin, 716.

as green manure, 320.

bagged, effect of humidity changes, 137.

Berkely Rock, description, Mich., 535.

blight, 240.

bran, analyses, Can., 167; Mich., 168; N.H., 675; Tex., 675.

bran ashes, analyses, 823.

bran, structure, 69.

bran, vitamin A and B content, 256.

bran with screenings, analyses, 871.

breeding experiments, 633.

bunt, notes, 741.

bunt, treatment, 742.

(See also Wheat smut, stinking.)

chalk v. lime for, 716.

chromosome relationships in, 430.

composition, studies at experiment stations, 607.

cost of production, Mo., 387.

cost of production in Italy, 291.

cracked, analyses, Tex., 675.

crop variation, 137.

crosses, genetic behavior of spelt form, 333.

cross-pollination, effects, 136.

cultural directions, Wash., 437.

culture, Mo., 34.

culture along the Nile, 495.

culture experiments, 227, 436, 437,

634; Mont., 830; U.S.D.A., 724.

culture experiments in Sudan, 34.

culture in Greece, 535.

disease survey in India, 544.

diseases in New South Wales, 545.

dockage removal at thrasher, 100.

drilling experiments, Mont., 327.

durum, as bread wheat, 536.

effect of premature harvesting, 36.

eradication of wild poppies in, 138.

Wheat—Continued.

- ergot, notes, 239, 240.
(See also Ergot.)
- fallowing experiments, 35.
- feeding value in pork production, 674.
- fertilizer experiments, 227, 435, 437, 634; Kans., 435; Ohio, 334.
- flour. (See Flour.)
- foot rot, 44.
- formaldehyde treated, germination, 241.
- frosted, milling and baking tests, Mont., 327.
- Fusarium blight, U.S.D.A., 240.
- green manuring experiments, N.J., 514.
- harvests, historical account, 389.
- hay yields in Australia, 132.
- improvement by selection, 830.
- inheritance of earliness, 35.
- irrigation experiments, 436, 634.
- irrigation experiments in India, 487.
- Kanrad, history and characteristics, U.S.D.A., 136.
- leaf color, relation to yield and composition, 35.
- lime *v.* chalk for, 716.
- liming experiments, 131; Md., 321.
- middlings, analyses, 871; N.H., 675.
- midge, notes, Ohio, 351.
- milling and baking tests, 634.
- milling yields as affected by humidity and moisture content, U.S.D.A., 665.
- mixed feed, analyses, 871; Mich., 168; N.H., 675; Tex., 675.
- moisture absorption, relation to humidity, 731.
- mummy, studies, 467.
- nutrient requirements, 716.
- nutrient solutions as affected by temperature, 629.
- orange leaf rust, aecial stage, 144.
- Piricularia on, 448.
- plant, monograph, 837.
- production in New Zealand, 788.
- production in South Africa, 441.
- production in Peru, 638.
- production, statistics, 391.
- productiveness and milling qualities, Ohio, 665.
- Pusa 12 and 4, characteristics, 638.
- root system as affected by fertilizers, 132.
- rotation experiments, 131, 436, 437; Kans., 435; Ohio, 334.
- rust resistance tests, 240.
- rye ergot on, 240.
- salt requirements, 26.
- scab, notes, 239; Iowa, 342; U.S.D.A., 240.
- scab, varietal susceptibility, Mo., 344.
- seeding experiments, Kans., 435.
- selection in New Zealand, 731.
- Septoria leaf spot, Iowa, 342.
- shorts, analyses, Tex., 675.
- smut, control, 546.
- smut, notes, 239, 544.

Wheat—Continued.

- smut, stinking, control, 546, 741; Mich., 448.
(See also Smut and Cereal smut.)
- speltoid form, crossed with wheat, 333.
- speltoid variations in, 442.
- spring and winter crosses, 632.
- stem rust, relation to grasses, 449.
- straw *v.* hay, feeding value, 765.
- take-all, 240.
- take-all, popular account, U.S.D.A., 145.
- topping to prevent lodging, 232.
- treated with formaldehyde, absorption and germination, 241.
- treatment, 449.
- varietal nomenclature, 829.
- varieties, Mich., 633; Mo., 327.
- varieties, baking strength, Can., 163.
- varieties, new, description, 531.
- varieties, standardization, Ohio, 394.
- variety tests, 131, 132, 227, 436, 437, 633, 634; Kans., 434; Mont., 327; N.H., 328; S.C., 725.
- winter and spring crosses, 632.
- winter, new hardy variety, 442.
- winter, seed bed preparation, Tex., 328.
- winter, tillage, Nebr., 837.
- winter, varieties in Sweden, 730.
- yellow rust, notes, 240.
- yields, Mont., 327.
- yields as affected by seeding rate, Ohio, 334.
- yields in Australia, 132.
- yields in New Jersey, 225.
- yields, relation to size of seed, 442.
- Whey butter, 772.
- White—
 - ants. (See Termites.)
 - fly, greenhouse, on tomatoes, control, 458.
 - grubs on rubber, 461.
 - grubs on sugar cane, 57, 250.
 - pine blister rust—
 - conference, conclusions, 850.
 - control, 49, 843.
 - growth and behavior, 851.
 - infection, distance of spread, 150.
 - notes, 243, 844.
 - temperature of spore germination, N.H., 343.
 - work in Oregon, 654.
 - pine needle blight, notes, 454.
 - pine seedlings, effect of time of transplanting, 142.
 - race in Tropics, metabolism, 671.
- Whitewash preparation and use, 688.
- Wild life resources of Louisiana, 554.
- Willow sawfly, notes, 51.
- Willows, *Cytospora chrysosperma* on, 850.
- Wilt diseases, new, in Australia, 44.
- Wind, effect on plant growth, 827.
- Wind function in fruit pollination, 840.
- Windmills, design, 287.
- Wireworms—
 - life history, 462.
 - studies, S.C., 747.

Wisconsin—

Station, notes, 97.

University, notes, 97, 199, 499, 700.

Women, basal metabolism, 166.

Women's Institutes—

Federation, organization, 792.

in Ontario, 696.

Wood—

ashes, analyses, R.I., 221.

ashes, fertilizing value, 818.

block pavement, wearing qualities, 780.

figure in, 143.

fuel value, Mich., 542.

in silo construction, Mich., 598.

pulp, sulphite process, modification, 808.

susceptibility to borer attack, 252.

textbook, 779.

ticks, cause of paralysis in children, 59.

waste, utilization, 114.

(See also Lumber and Timber.)

Woodland industries around Oxford, 788.

Woods—

coniferous, soda and sulphate pulps from, 617.

Formosan, characters and identification, 143.

identification, 542, 843.

in South Africa suitable for matches, 287.

Japanese, characters and identification, 143.

of the world, bibliography, 737.

Philippine, tests, 283.

Wood-using industries of New York, 739.

Wool—

as affected by thyroidectomy, 72.

combing, treatise, 72.

industry in Union of South Africa, 873.

international trade, 675.

Karakul curl, method of inheritance, 270.

quality, station projects, 609.

resources of British Empire, 391.

score card for, 677.

Woolly aphid. (See Aphis, woolly.)

Wyoming University and Station, notes, 199.

X-rays. (See Roentgen rays.)

Xerophthalmia and vitamin A, relation, 760.

Xylaria hypoxylon constituents, comparative utilization, 723.

Yams, variety tests, 226.

Yeast—

as growth stimulant for infants, 759.

autoxidizable constituent, 110.

deficiency in rations of pigeons, effect, 570.

effect on polyneuritis, 470.

enzymes, effect of yeast extract on, 759.

extracts, alcoholic, for polyneuritis, 569.

in bread, nutritive value, 759.

in diet, antirachitic value, 473.

vitamin and coenzyme, differentiation, 309.

vitamin requirements, 759.

Yellow-fever mosquito. (See *Stegomyia*.)

Yellow rattle, control, 727.

Yew disease, obscure, 741.

Ypsolophus marginellus, notes, 750.

Zamia—

as food substitute, 755.

starch situation, 308.

Zatropis tortricidis n.sp., description, 254.*Zea mays*, stomata structure, factors affecting, 322.*Zele* sp., parasitism by, 247.*Zenillia roseanae*, studies, 57.*Zenodosus sanguineus* larva, notes, 857.

Zinc—

content of human brain, 861.

content of marine animals, 260.

determination, 111.

determination, use of membrane filters, 614.

distribution in fish, 566.

distribution in oysters, 260.

in rabbits, variation during growth, 667.

Zoology for medical students, textbook, 773.

Zygothrips nidicola, parasitism by, 457.

ADDITIONAL COPIES

OF THIS PUBLICATION MAY BE PROCURED FROM
THE SUPERINTENDENT OF DOCUMENTS
GOVERNMENT PRINTING OFFICE
WASHINGTON, D. C.

AT

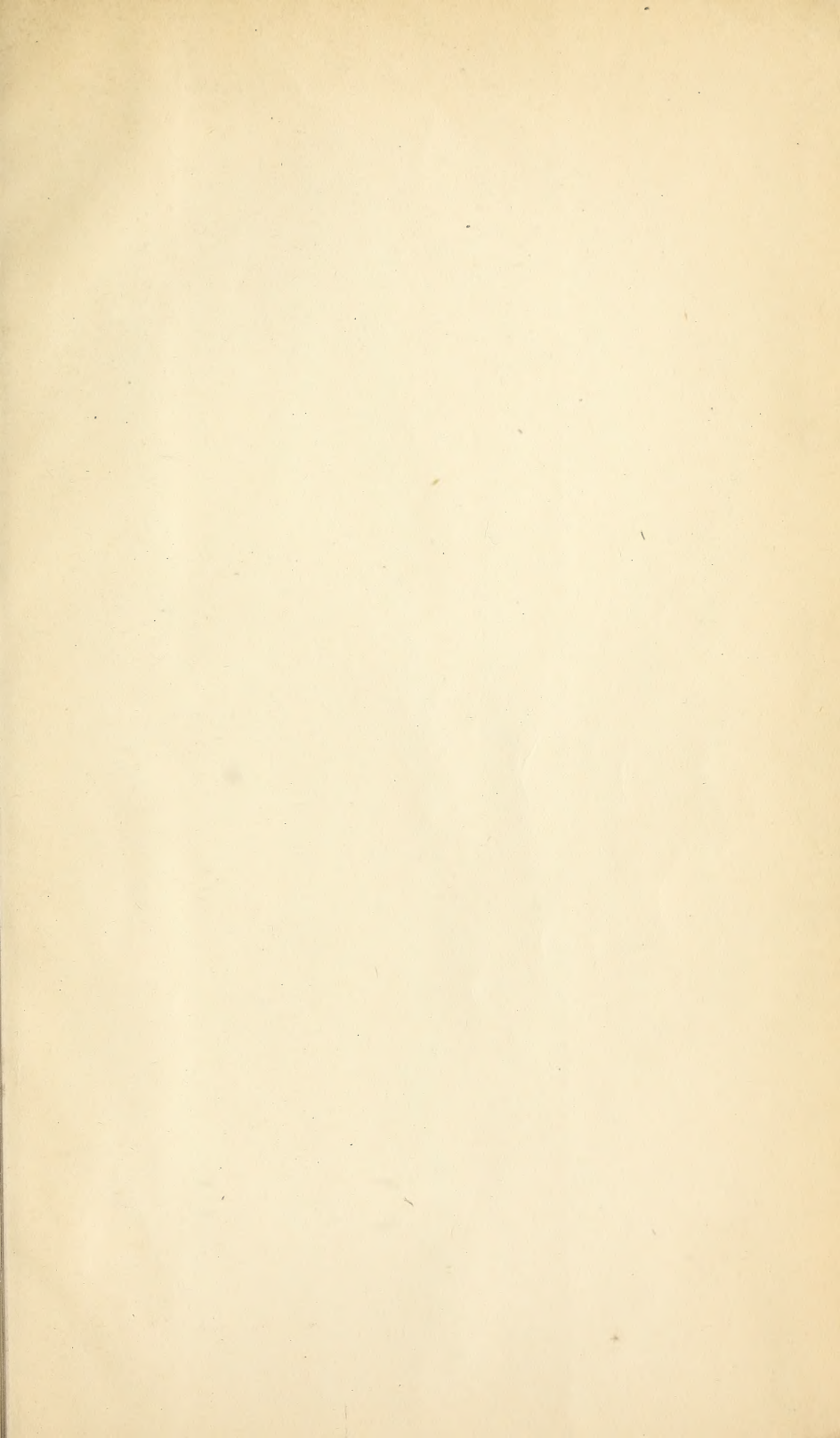
10 CENTS PER COPY

SUBSCRIPTION PRICE, 75 CENTS PER VOLUME











Record.

GPO 8-2652

